Attachment 8

Water Quality and Other Expected Benefits

Integrated Regional Water Management Implementation
Prop 84, Round 1

Santa Ana Watershed Project Authority

Santa Ana One Water One Watershed IRWM
Prop 84, Round 1 Implementation Proposal

Project (a) Groundwater Replenishment System - Flow Equalization

B. Water Quality and Other Benefits:

Narrative discussion of the estimates of without-project physical:

Elevated salinity (or salts or TDS) in Orange County groundwater basin can negatively impact groundwater supplies, constrain the implementation of water recycling projects and cause other negative economic impacts such as the need for increased water treatment by water utilities. The without-project conditions reflect zero flow-weighted average TDS concentrations of secondary effluent. No flow of secondary effluent translates to zero flow-weighted average TDS concentration and, consequently, zero salt/contaminant removal.

Narrative discussion of the estimates of with-project physical condition:

A salt imbalance exists in the Orange County groundwater basin which means there is a greater quantity of salts that enters the basin each year compared to the amount of salts that leave the basin. The construction and implementation of the GWRS Flow Equalization Project will improve the salt balance in the groundwater basin over time. The salt/contaminant removal is determined as the difference of flow-weighted average TDS concentrations of secondary effluent feed to GWRS and the GWRS product water.

Description of methods used to estimate without- and with-project condition:

Section 5 of OCWD's Groundwater Management Plan discusses and provides the estimates of flow-weighted average TDS concentrations of inflow and outflow (as indicated by GWRS water injected to Talbert barrier). Salinity or TDS is measured in OCWD's Quality Assurance Laboratory (a State-certified laboratory) by evaporating a known amount of water sample to dryness and measuring the remaining salts according to Standard Methods for the Examination of Water and Wastewater.

Description of potential other benefits:

The advanced treatment technologies utilized at GWRS effectively remove pharmaceuticals and emerging contaminants of concern (both the precursors and the chemical compounds).

Description of the distribution of local, regional, and statewide benefits, as applicable:

This project creates a locally-available, reliable supply of high-quality water; improves groundwater quality by reducing the amount of salts/dissolved solids in Orange County's groundwater basin; diversifies water supplies in Southern California by providing high-quality recycled water; and protects Orange County's groundwater basin from water quality degradation caused by seawater intrusion.

Identification of beneficiaries:

Any water quality improvement in the recharge water supply will benefit the Orange County groundwater basin and all groundwater producing agencies in Orange County. OCWD's service area covers more than 350 square miles, providing groundwater supplies to more than 20 cities and water agencies. Other Southern California agencies also benefit from the water quality improvement in the Orange County region.

When the benefits will be received:

The California Department of Public Health permit requirements specify that the GWRS water cannot reach drinking water wells for at least six months. Therefore, the water quality benefits will be received by the groundwater producing agencies in Orange County within the first year of operation. The allowable pumping level will be set based on new additional water supplied by this project.

Uncertainty of Benefits:

There is no uncertainty associated with this benefit because the advanced treatment processes utilized at the GWRS have demonstrated to be very effective in removing all types of water contaminants (both organic and inorganic). High-quality water produced by the GWRS exceeds all state and federal drinking water standards.

Description of any adverse effects:

Based on OCWD's track record and experience of successful water recycling operation for nearly four decades, OCWD is confident that there are no adverse effects of any kind.

Table 16 - Water Quality and Other Expected Benefits
(All benefits should be in 2009 dollars)
Project (a) Groundwater Replenishment System - Flow Equalization (OCWD)

(a)	(b)	(c)	(d)	(e)	(f)	(g)	(h)	(i)	(j)
Year	Type of Benefit	Measure of Benefit (Units)	Without Project	With Project	Change Resulting from Project (e) – (d)	Unit $ Value (1)	Annual $ Value (f) x (g) (1)	Discount Factor (1)	Discounted Benefits (h) x (i) (1)
2009	Salt/contaminant removal	mg/L			0		$0	1.000	$0
2010	Salt/contaminant removal	mg/L			0		$0	0.943	$0
2011	Salt/contaminant removal	mg/L			0		$0	0.890	$0
2012	Salt/contaminant removal	mg/L			0		$0	0.840	$0
2013	Salt/contaminant removal	mg/L			0		$0	0.792	$0
2014	Salt/contaminant removal	mg/L	0	935	935	$1	$2,988,840	0.747	$2,232,663
2015	Salt/contaminant removal	mg/L	0	935	935	$1	$5,977,679	0.705	$4,214,264
2016	Salt/contaminant removal	mg/L	0	935	935	$1	$5,977,679	0.665	$3,975,157
2017	Salt/contaminant removal	mg/L	0	935	935	$1	$5,977,679	0.627	$3,748,005
2018	Salt/contaminant removal	mg/L	0	935	935	$1	$5,977,679	0.592	$3,538,786
2019	Salt/contaminant removal	mg/L	0	935	935	$1	$5,977,679	0.558	$3,335,545
2020	Salt/contaminant removal	mg/L	0	935	935	$1	$5,977,679	0.527	$3,150,237
2021	Salt/contaminant removal	mg/L	0	935	935	$1	$5,977,679	0.497	$2,970,907
2022	Salt/contaminant removal	mg/L	0	935	935	$1	$5,977,679	0.469	$2,803,532
2023	Salt/contaminant removal	mg/L	0	935	935	$1	$5,977,679	0.442	$2,642,134
2024	Salt/contaminant removal	mg/L	0	935	935	$1	$5,977,679	0.417	$2,492,692
2025	Salt/contaminant removal	mg/L	0	935	935	$1	$5,977,679	0.394	$2,355,206
2026	Salt/contaminant removal	mg/L	0	935	935	$1	$5,977,679	0.371	$2,217,719
2027	Salt/contaminant removal	mg/L	0	935	935	$1	$5,977,679	0.350	$2,092,188
2028	Salt/contaminant removal	mg/L	0	935	935	$1	$5,977,679	0.331	$1,978,612
2029	Salt/contaminant removal	mg/L	0	935	935	$1	$5,977,679	0.312	$1,865,036

Table 16 - Water Quality and Other Expected Benefits

(All benefits should be in 2009 dollars)

Project (a) Groundwater Replenishment System - Flow Equalization (OCWD)

(a)	(b)	(c)	(d)	(e)	(f)	(g)	(h)	(i)	(j)
Year	Type of Benefit	Measure of Benefit (Units)	Without Project	With Project	Change Resulting from Project (e) – (d)	Unit $ Value (1)	Annual $ Value (f) x (g) (1)	Discount Factor (1)	Discounted Benefits (h) x (i) (1)
2030	Salt/contaminant removal	mg/L	0	935	935	$1	$5,977,679	0.294	$1,757,438
2031	Salt/contaminant removal	mg/L	0	935	935	$1	$5,977,679	0.278	$1,661,795
2032	Salt/contaminant removal	mg/L	0	935	935	$1	$5,977,679	0.262	$1,566,152
2033	Salt/contaminant removal	mg/L	0	935	935	$1	$5,977,679	0.247	$1,476,487
Total Present Value of Discounted Benefits Based on Unit Value (Sum of the values in Column (j) for all Benefits shown in table) Transfer to Table 20, column (f), Exhibit F: Proposal Costs and Benefits Summaries									52074554.09

Comments: The unit value of $0.413 per mg/L per acre-foot (af) of water comes from the Final Report of "Salinity Mangaement Study" conducted jointly by the Metropolitan Water District of Southern California (MWD) and U.S. Bureau of Reclamation (June 1999). This benefit value was developed for MWD's service area. Using the update factor of 1.29 provided by DWR, the unit value of $0.413/mg/L/af has been converted to $0.533/mg/L/af to reflect 2009 dollars. The anticipated salt/contaminant removal of 935 mg/L is calculated as difference of the recent average values of secondary wastewater effluent (approximately 1,000 mg/L) and the GWRS product water (65 mg/L). The construction of this project will be fully completed before the first half of 2014. OCWD anticipates that the operation of this project will commence on July 1, 2014 (i.e., the second half of 2014) and the water quality benefit will occurr on July 1, 2014 as well. The salt/contaminant removal for 2014 has been pro-rated to 50% of the annual water quality benefit as indicated by this Table. Starting in 2015 and thereafter, this project will achieve 100% of the water quality benefit as presented in this Table.

(1) Complete these columns if dollar value is being claimed for the benefit.

Project (b) Sludge Dewatering, Odor Control, and Primary Sludge Thickening

B. Water Quality and Other Benefits:

With Orange County's population projected to keep increasing, Southern California is facing future water supply shortages as current supplies are dwindling. Climatic changes within the region are also resulting in droughts, which is reducing natural water replenishment. The Sludge Dewatering, Odor Control, and Primary Sludge Thickening Project at Plant No. 1, P1-101 project, will provide a local source of water to the region.

In an effort to be proactive and avoid a water shortage, OCSD, in equal partnership with OCWD, is addressing the water supply needs for Orange County by expanding the GWRS that will increase the utilization of treated wastewater from OCSD for indirect potable reuse after advanced water treatment. In order to ensure that there is an adequate and consistent supply of treated wastewater, certain infrastructure changes will need to be implemented. The P1-101 project will upgrade of OCSD's facilities to meet secondary requirements and provide a reliable water supply that is necessary for the GWRS to be successful.

Narrative discussion of the estimates of without-project physical:

Orange County Sanitation District conducted a preliminary evaluation of the construction of a diversion for the SARI line and a secondary effluent pump station at Plant No. 2 to provide effluent to GWRS, during the Strategic Plan Update in 2002, available upon request. The SARI diversion at Plant No. 2 would be required due to the water quality of the brine in the line it cannot be used for reclamation and must be directed to the ocean outfall and would require a diversion to treat the SARI which would include separate headworks and primary treatment. The effluent from Plant No. 2 that has the adequate water quality to be used for reclamation would be treated and then pumped to GWRS as source water, a separate pipeline to convey the secondary effluent would be required.

Narrative discussion of the estimates of with-project physical condition:

The P1-101 project includes the construction of sludge dewatering facilities to treat the additional sludge produced from new activated sludge wastewater treatment processes and an odor control system. The secondary upgrades will increase the amount of treated wastewater by approximately 38,000 afy that will be available as source water for GWRS to produce approximately 30,000 afy of additional recycled water to be used for reclamation. Ultimately, the implementation of secondary treatment upgrades will improve water quality and maintain the coastal environment within the region.

Description of methods used to estimate without- and with-project condition:

The current conditions (without a project) and future conditions (with project) of OCSD's service area are studied in order to prepare the strategic plan updates. In order to ascertain the priority of capital improvements at OCSD a variety of studies are conducted for each project such as a feasibility study, conceptual alternatives, cost estimates, and program schedule. The long-term Capital Improvements Program requirements are determined through comprehensive planning efforts undertaken every seven to ten years. The Facilities Master Plan was updated in 2009 to determine the future needs of OCSD through the year 2030.

Description of potential other benefits:

Benefits derived directly from construction of the P1-101 Project for water supply will be:

1) Reduction of energy demand based on power production from digester gas treated at Plant No. 1 and
2) Reduction of greenhouse gas emissions based on the reduction of trucks hauling solids offsite.

Other benefits based on the water supply/source water to produce recycled water include:

1) reduction of greenhouse gas emissions based on less water being imported from outside the region and
2) Reduction of Total Dissolved Solids (TDS) in the Orange County Groundwater Basin.

These benefits are discussed below.

Description of the distribution of local, regional, and statewide benefits, as applicable:

The additional source of water produced by P1-101 that will be treated by GWRS for the production of recycled water will be used to replenish the Orange County Groundwater Basin that serves the north and central portion of Orange County.

The additional local source of water will aid the region by minimizing the amount of imported water to the region. It will also assist in achieving some of the goals established in the One Water, One Watershed (OWOW) 2009 Santa Ana Integrated Watershed Plan, An Integrated Regional Water Management Plan, Section 6.0, Table 6-1, Page 4 of 9.

- Provide reliable water supply
- Preserve and enhance the environment
- Promote sustainable water solutions
- Ensure high quality water for all users

The state will benefit by the reduction of greenhouse gas emission and help the state achieve the Climate Change Action Plan which has set a goal of reducing emissions levels to 1990 levels by 2020 and 80% below those levels by 2050, (Climate Change Proposed Scoping Plan, October 2008, page ES-2).

The CALFED Bay-Delta Program objectives has established the Water Use Efficiency Program with a three-pronged approach through conservation, desalination and recycling was created in 2000 with the signing of the CALFED Record of Decision, as described on the CALFED website http://calwater.ca.gov/calfed/objectives/Water_Supply_Reliability.html. This program seeks to reduce the mismatch between Delta water supplies, and current and projected beneficial uses dependent upon the Bay-Delta system. The P1-101 Project will contribute to the attainment the water supply objectives by increasing recycled water production.

Identification of beneficiaries:

The direct beneficiaries of the benefit from the construction of P1-101 will be the north and central Orange County Residents in the OCSD and OCWD service area.

When the benefits will be received:

The project has a completion date of 2015, it is expected that benefits will begin as soon as the project is completed.

Uncertainty of Benefits:

The P1-101 project does not have foreseeable uncertainty of benefits. The additional source water to be provided to the GWRS will produce additional recycled water, and since the technology and the water quality parameters are in accord with the Regional Water Quality Control Board (RWQCB) and the GWRS permit, the water quality is known.

OCSD administers a permit program through the Source Control Division to provide a means for protecting the public and environment through the regulation of industrial discharges. The permit program limits the discharge of specific pollutants from industrial facilities and maintains the water quality of the influent at the district. Compliance with the OCSD's NPDES permit as it relates to wastewater discharge involves a number of programs to assure that the effluent discharged to the ocean meets the limits established by the Environmental Protection Agency (EPA). These activities include pretreatment programs that keep industrial and non-industrial sources out of the water stream, frequent monitoring of influent and effluent for conventional, non-conventional, and priority pollutants, and provisions of reports of monitoring results in monthly, quarterly, and annual reports.

Description of any adverse effects:

The P1-101 project does not have any foreseeable adverse effects, by minimizing the amount of secondary effluent released to the ocean the project will help maintain the coastal environment. The recycled water produced by GWRS can provide better water quality than Metropolitan Water District import to the region from the Colorado River and is treated at the Robert B. Diemer Plant in Yorba Linda, GWRS produces water with a lower TDS levels. The project will generate power by increase its capacity to treat additional digester gas, which will reduce the current demand on the energy grid and will reduce greenhouse gas emissions.

Energy Savings

The P1-101 project improvements will increase wastewater treatment by 34 mgd which will increase the amount of digester produced that can be used to create power for use at Plant No. 1. Calculation for sludge gas production are shown on Table 8-1, the calculations are based on 34 mgd of additional wastewater treated, 42,500 cf/day (34 mgd × 1250 cf/MG) of additional sludge treatment, 781 kcf/day (34 mdg × 22.98 kcf/MG) of additional gas generated and 44,300 kW/day (781 kcf/day × 56.72 kWh/kcf) of additional electricity generated.

Table 8-1 PLANT # 1 Data July 2008 thru June 2009

	Average Daily Wastewater Influent (MGD)	Average Daily Sludge Production (cf/day)	Sludge Production per MG Wastewater Influent (cf/MG)	Average Daily Gas Production (kcf/day)	Gas Production per MG Wastewater Influent (kcf/MG)	Elect. Generated (kwh)	Digester gas usage Quantity (kscf)	H.H.V. (Btu/cu.ft)	Heat Value (therms)	kWh/kscf
Jul 08	90	110352	1226	2074	23.0	2,977,019	51,339	630	323,436	57.99
Aug	89	108730	1222	2072	23.3	3,008,000	52,581	623	327,580	57.21
Sep	88	106888	1215	2035	23.1	2,944,000	51,597	626	322,997	57.06
Oct	86	109149	1269	2065	24.0	3,008,000	52,916	631	333,900	56.84
Nov	85	106118	1248	2006	23.6	2,864,000	50,683	624	316,262	56.51
Dec	84	106240	1265	2021	24.1	3,256,000	55,913	629	351,693	58.23
Jan 09	81	111235	1373	2077	25.6	3,456,000	57,627	632	364,203	59.97
Feb	84	116318	1385	2105	25.1	2,928,854	51,953	629	326,784	56.38
Mar	83	108372	1306	1971	23.7	2,544,065	57,175	632	361,346	44.50
Apr	83	97766	1178	1654	19.9	2,819,988	50,239	635	319,018	56.13
May	83	101027	1217	1755	21.1	3,065,190	50,440	634	319,790	60.77
Jun	98	107325	1095	1877	19.2	3,061,538	51,019	637	324,991	60.01
TOTAL			**1250**		**22.9828**	35,932,654	633,482		3,991,998	56.72

Based on OCSD's fiscal year 2009 flow meter records (available upon request) on average approximately 1,250 cf/day of sludge (solids) is treated. During the treatment of sludge (solids) it is estimated, based on OCSD's plant operations records, an average 22.98 kscf/MG of digester gas is produced. From OCSD's Power Model and plant records it was determined that in 2009, a total of 35,932,654 kWh were generated and 633,482 ksfs of digester gas was consumed, with a factor of 56.72 kWh/kscf (35,932,654kWh/633,482kscf = 56.72), see Attachment 8-C. The estimated cost per kW is $0.08 based OCSD's Power Model for fiscal year 2009.

Based on averages calculated from the meter records the additional wastewater treated by the P1-101 project is projected to produce an additional 44,300 kWh/day (22.98 kscf/MG × 34 MGD × 56.72 kWh/kscf) = 44,316.47 kWh/day) of electricity with approximately $1.3 million (44300Kwh/day × 365 days × $0.08/kW = $1,294,041) in energy cost savings.

Greenhouse Gas Emissions Reduction

According to the Environmental Protection Agency greenhouse gases tend to trap heat in atmosphere, which is the source of climate change, as stated on the website http://www.epa.gov/climatechange/emissions/index.html. The reduction of greenhouse gases emissions (GGE) will aid in the reduction of cost to GGE cleanup.

The P1-101 project improvements will reduce the amount of carbon-dioxide being produced by burning fossil fuels for automotive transportation and power needed to transport water from outside the region.

The P1-101 project improvements consists of the installation of centrifuges that will increase the dewatering of solids, it is estimated that every 10% change in water results in about 25% change in weight, for example by increasing the cake composition from 30% solids/70% water to 40% solids/60%water there will be more solids and therefore the cake will be approximately 25% heavier. The byproduct of the centrifuges will have less water, so the number of trucks needed for disposal is reduced by approximately 8 trucks a day. The round trip to haul the solids to Kern County is approximately 400 miles, with 5 miles per gallon of diesel the consumption of diesel will be reduced by approximately 640 gallons or 91.4 barrels of oil see Table 8-2.

Table 8-2 GHG Analysis for Solids on P1-101

P1-101 Results

Parameter	**Value**	
Projected change in percent solids from P1-101	10%	
Estimated 2012 BFP tons per day	700	
Estimated 2012 centrifuge tons per day	500	(every 10% change in water results in about 25% change in weight)
Biosolids tons per truck	25	
Less trucks with centrifuges	8	
One-way Miles to Kern Site	200	
Round trip miles	400	
Avoided truck miles per day with centrifuges	3200	
Truck miles to diesel gallon	5	
Diesel gallons avoided per day	640	
Diesel gallons produced per barrel of oil	7	
Barrels of oil avoided per day	**91.4**	

P1-101 Demands

Parameter	Value
Power usage for dewatering centrifuges (kW)	5000
Power generated per barrel of oil (kW-hr)	1700
Hours per day	24
Barrels of oil used per hour	2.9
Barrels of oil used per day	**70.6**

Barrel of oil CO2 eq	317	kg
P1-101 CO2 Reductions	28982.86	kg/d
P1-101 CO2 Increases	22376.47	kg/d
Net P1-101 Savings	6606.387	kg/d
Annual P1-101 Net Savings (metric)	**2,411,331**	**kg/yr**
Annual P1-101 Net Savings (English)	**1,094,567**	**lbs/yr**
Annual P1-101 Net Savings (English)	**547**	**tons/yr**

The centrifuges will consume more energy to reduce the water in the solids, it is estimated that an additional 5,000 kW will be used each day, it is estimated that each barrel of oil produces approximately 1,700 kWh; the additional barrels of oil that will be needed to power the centrifuges is approximately 70.6. From the improvements that P1-101 project will create there will be a savings of approximately 20 barrels of oils per day (91.4 – 70.6 = 20.8). Each barrel of oil is estimated to produce 317 kg of CO_2, yielding in a savings of 6,600 kg/d (550 tons/year) savings of emissions.

The cost of GGE reduction by less truck miles is approximately $13,175 (500 tons/yr × $50/ton in 2030 × 0.527 factor to convert from 2030 to 2009 dollars = $13,175)

The construction of P1-101 will supply 38,080 AFY of source water to GWRS to produce 31,000 AFY of purified recycled water to replenish the groundwater basin, which will reduce the amount of import water needed in the region.

Assumptions:

1) 31,000 AF per year of water that will not be imported to the region.
2) 9,727 KWh/MG = 3,170 KWh/AF factor for energy used to transport water to Southern California. California Energy Commission "Refining Estimates of Water–Related Energy Use in California," December 2006.
3) 0.435 lbs of CO_2/KWh average factor for the entire state of California to transport water. Carbon Dioxide Emissions Rate, Department of Energy, July 2000.

3,170 KWh/AF × 31,000 AF/yr = 98270000 KWh/yr

98270000 KWh/yr × 0.435 lbs of CO_2/KWh = 42747450 lbs of CO_2/yr

42747450 lbs of CO_2/yr ÷ 2204.6 lbs/metric ton = 19,390.12 tons of CO_2/yr

Total Greenhouse Gas Emissions reduced by the project is **19,390 tons of CO_2/yr**

McKinsey and Company's study "Reducing U. S. Greenhouse Gas Emissions: How Much at What Cost?" is provided by the California Office of the Attorney General as a reference for greenhouse gas emissions, in this documents it is estimated that in 2020 average GGE abatement rate will be $50 per ton, the project yearly savings in GGE cleanup is estimated at $27,500 in 2020 ($13,000 in 2009 dollars).

The construction of P1-101 will supply approximately 38,000 AFY of source water to GWRS to produce 31,000 AFY of recycled water to replenish the Orange County groundwater basin, which will reduce the amount of import water needed in the region. Based on the 9,727 KWh/MG = 3,170 KWh/AF factor for energy used to transport water to Southern California, provided by the California Energy Commission's "Refining Estimates of Water–Related Energy Use in California" published in December 2006, and 0.435 lbs of CO_2/KWh average factor for the entire state of California to transport water, provided by the Department of Energy "Carbon Dioxide Emissions Rate" in July 2000.

Greenhouse Gas Emissions reduced by avoiding import of water to the region is 19,000 tons of CO_2/yr. With the rate of GGE emission cost of $50, as referenced above, P1-101's yearly savings are estimated at $5000,650 in 2020 ($950,000 × $50/ton in 2030 × 0.527 factor to convert from 2030 to 2009 dollars = $500,650 2009 dollars).

Water Quality Improvement by TDS reduction

The P1-101 project will provide the source water for GWRS to produced recycled water. The recycled water produced by GWRS has very low total dissolved solids (TDS) or salt levels. This will result in lowering the overall TDS content of the groundwater basin. The water quality in Orange County which suffers from higher than desired total dissolved solids (TDS) levels. Salts build up in the groundwater when recharge sources are comprised of higher TDS supplies high TDS water requires additional treatment to remove the salts prior to use by agriculture; households; water and wastewater utility systems; and industrial facilities. In 1986, the US Bureau of Reclamation estimated that the total cost to a household from high TDS water ranged from $66 to $134 per year (in 1986 dollars). TDS levels in Orange County are comparable. Costs for regulation, agriculture and industry charges would add to this cost. After an allowance for inflation (about 3% per year), present day costs could range from $130 to $270 per year per household based on the Metropolitan Water District (MET) and U.S. Bureau of Reclamation's "Salinity Management Study Final Report: Long Term Strategy and Recommendation Acton Plan" published in 1999. Since a household uses ½ acre-foot of water per year, the cost of the higher salinity water is at least $260 to $540 per acre-foot. Industries, water and wastewater utilities incur additional costs due to higher levels of salinity because there is a reduction in useful life and system facilities and equipment must be replaced at a more rapid rate. Additional costs are also incurred due to regulatory restrictions imposed by regional water quality standards and management programs to protect groundwater supplies.

The OCSD-OCWD (north-central Orange County) service area receives water from the Santa Ana River (SAR) and imported water from the Colorado River Aqueduct (CRA) and the State Water Project (SWP). The first two sources of water have high TDS levels. The highest TDS water is the SAR water. The base flow in the SAR is largely secondary effluent from wastewater treatment plants that discharge upstream. Water received from the Colorado River Aqueduct is also high in salinity. SWP water is of very high quality, but it does not make up a high enough percentage of the total water used to counter-act the two high salinity sources. Therefore, the quality of Orange County's groundwater is mostly dependent on the quality of the SAR water and water from the CRA. The water quality pumped from the groundwater basin currently reflects the higher salinity levels, with total dissolved solid levels generally above 650 mg/l, based on the Santa Ana River Wasteload allocation Model Report, dated May 2009, page 2-11, and RWQCB Order No. 01-23, NPDES No. CA0105694 Waste Discharge Requirements for The Metropolitan Water District of Southern California Robert B. Diemer Filtration Plant, Yorba Linda, Orange County, page 3 of 14, see attached. The Regional Water Quality Control Board has set a recharge goal of 600 mg/l of TDS. U.S. EPA and many health agencies use a level of 500 mg/l TDS as a recommended drinking water standard.

The higher quality recycled water produced by GWRS will provide about 590 mg/L (650 mg/L – 60 mg/L) of salt reduction in the water, the benefit is based on the Metropolitan Water District (MET) and U.S. Bureau of Reclamation's "Salinity Management Study Final Report: Long Term Strategy and Recommendation Acton Plan" published in 1999. $95 million of region benefits with a salinity decrease of 100 mg/L for imported water (Pg. 30 of 70 of PDF). The approximate afy for the MET area benefit was identified as 2,300,000 afy; benefit was calculated at $0.413/mg/L/afy in 1999. To bring the benefit factor to 2009 dollars equivalent it was multiplied by a factor of 1.29 = $0.533/mg/L/afy.

Thus, P1-101 project will produce 31,000 afy of recycled water with an approximate TDS level of 60 mg/L, the current Colorado River Aqueduct levels are approximately 650 mg/l based on the OWOW chapter 5.2. The construction of the project will create a total reduction of 590 mg/L. The total yearly savings of the project are approximately \$9.7 million (31,000 afy × 590 mg/L × \$0.533/mg/L/afy = \$97,485,570), as shown on Table 16.

It is estimated that the Total Present Value of Discounted Benefits (energy savings, greenhouse gases and improved water quality) Based on Unit Value will be approximately \$136,563,695 for the life of the project.

Table 16 - Water Quality and Other Expected Benefits

(All benefits should be in 2009 dollars)

Project (b) Sludge Dewatering, Odor Control, and Primary Sludge Thickening (OCSD)

(a) Year	(b) Type of Benefit	(c) Measure of Benefit (Units)	(d) Without Project	(e) With Project	(f) Change Resulting from Project (e) – (d)	(g) Unit $ Value (1)	(h) Annual $ Value (f) x (g) (1)	(i) Discount Factor (1)	(j) Discounted Benefits (h) x (i) (1)
2015	a	kW	0	16175512	16175512	$0	$1,294,041	0.705	$912,299
	b	tons/yr	0	500	500	$26	$13,175	0.705	$9,288
	c	tons/yr	0	19000	19000	$26	$500,650	0.705	$352,958
	d	afy	0	31000	31000	$314	$9,748,570	0.705	$6,872,742
2016	a	kW	0	16175512	16175512	$0	$1,294,041	0.665	$860,659
	b	tons/yr	0	500	500	$26	$13,175	0.665	$8,763
	c	tons/yr	0	19000	19000	$26	$500,650	0.665	$332,979
	d	afy	0	31000	31000	$314	$9,748,570	0.665	$6,483,719
2017	a	kW	0	16175512	16175512	$0	$1,294,041	0.627	$811,943
	b	tons/yr	0	500	500	$26	$13,175	0.627	$8,267
	c	tons/yr	0	19000	19000	$26	$500,650	0.627	$314,132
	d	afy	0	31000	31000	$314	$9,748,570	0.627	$6,116,716
2018	a	kW	0	16175512	16175512	$0	$1,294,041	0.592	$765,984
	b	tons/yr	0	500	500	$26	$13,175	0.592	$7,799
	c	tons/yr	0	19000	19000	$26	$500,650	0.592	$296,351
	d	afy	0	31000	31000	$314	$9,748,570	0.592	$5,770,487
2019	a	kW	0	16175512	16175512	$0	$1,294,041	0.558	$722,626
	b	tons/yr	0	500	500	$26	$13,175	0.558	$7,357
	c	tons/yr	0	19000	19000	$26	$500,650	0.558	$279,576
	d	afy	0	31000	31000	$314	$9,748,570	0.558	$5,443,855
2020	a	kW	0	16175512	16175512	$0	$1,294,041	0.527	$681,723
	b	tons/yr	0	500	500	$26	$13,175	0.527	$6,941
	c	tons/yr	0	19000	19000	$26	$500,650	0.527	$263,751
	d	afy	0	31000	31000	$314	$9,748,570	0.527	$5,135,713
2021	a	kW	0	16175512	16175512	$0	$1,294,041	0.497	$643,135
	b	tons/yr	0	500	500	$26	$13,175	0.497	$6,548
	c	tons/yr	0	19000	19000	$26	$500,650	0.497	$248,822
	d	afy	0	31000	31000	$314	$9,748,570	0.497	$4,845,012
2022	a	kW	0	16175512	16175512	$0	$1,294,041	0.469	$606,731
	b	tons/yr	0	500	500	$26	$13,175	0.469	$6,177
	c	tons/yr	0	19000	19000	$26	$500,650	0.469	$234,737
	d	afy	0	31000	31000	$314	$9,748,570	0.469	$4,570,766
2023	a	kW	0	16175512	16175512	$0	$1,294,041	0.442	$572,388
	b	tons/yr	0	500	500	$26	$13,175	0.442	$5,828
	c	tons/yr	0	19000	19000	$26	$500,650	0.442	$221,450
	d	afy	0	31000	31000	$314	$9,748,570	0.442	$4,312,043
2024	a	kW	0	16175512	16175512	$0	$1,294,041	0.417	$539,988
	b	tons/yr	0	500	500	$26	$13,175	0.417	$5,498
	c	tons/yr	0	19000	19000	$26	$500,650	0.417	$208,915
	d	afy	0	31000	31000	$314	$9,748,570	0.417	$4,067,965
2025	a	kW	0	16175512	16175512	$0	$1,294,041	0.394	$509,423
	b	tons/yr	0	500	500	$26	$13,175	0.394	$5,187
	c	tons/yr	0	19000	19000	$26	$500,650	0.394	$197,090
	d	afy	0	31000	31000	$314	$9,748,570	0.394	$3,837,703
2026	a	kW	0	16175512	16175512	$0	$1,294,041	0.371	$480,588
	b	tons/yr	0	500	500	$26	$13,175	0.371	$4,893
	c	tons/yr	0	19000	19000	$26	$500,650	0.371	$185,934
	d	afy	0	31000	31000	$314	$9,748,570	0.371	$3,620,475
2027	a	kW	0	16175512	16175512	$0	$1,294,041	0.350	$453,385
	b	tons/yr	0	500	500	$26	$13,175	0.350	$4,616
	c	tons/yr	0	19000	19000	$26	$500,650	0.350	$175,409
	d	afy	0	31000	31000	$314	$9,748,570	0.350	$3,415,542
2028	a	kW	0	16175512	16175512	$0	$1,294,041	0.331	$427,721
	b	tons/yr	0	500	500	$26	$13,175	0.331	$4,355
	c	tons/yr	0	19000	19000	$26	$500,650	0.331	$165,481
	d	afy	0	31000	31000	$314	$9,748,570	0.331	$3,222,210
2029	a	kW	0	16175512	16175512	$0	$1,294,041	0.312	$403,511

Table 16 - Water Quality and Other Expected Benefits

(All benefits should be in 2009 dollars)

Project (b) Sludge Dewatering, Odor Control, and Primary Sludge Thickening (OCSD)

(a) Year	(b) Type of Benefit	(c) Measure of Benefit (Units)	(d) Without Project	(e) With Project	(f) Change Resulting from Project (e) – (d)	(g) Unit $ Value (1)	(h) Annual $ Value (f) x (g) (1)	(i) Discount Factor (1)	(j) Discounted Benefits (h) x (i) (1)
	b	tons/yr	0	500	500	$26	$13,175	0.312	$4,108
	c	tons/yr	0	19000	19000	$26	$500,650	0.312	$156,114
	d	afy	0	31000	31000	$314	$9,748,570	0.312	$3,039,820
2030	a	kW	0	16175512	16175512	$0	$1,294,041	0.294	$380,670
	b	tons/yr	0	500	500	$26	$13,175	0.294	$3,876
	c	tons/yr	0	19000	19000	$26	$500,650	0.294	$147,277
	d	afy	0	31000	31000	$314	$9,748,570	0.294	$2,867,755
2031	a	kW	0	16175512	16175512	$0	$1,294,041	0.278	$359,123
	b	tons/yr	0	500	500	$26	$13,175	0.278	$3,656
	c	tons/yr	0	19000	19000	$26	$500,650	0.278	$138,941
	d	afy	0	31000	31000	$314	$9,748,570	0.278	$2,705,429
2032	a	kW	0	16175512	16175512	$0	$1,294,041	0.262	$338,795
	b	tons/yr	0	500	500	$26	$13,175	0.262	$3,449
	c	tons/yr	0	19000	19000	$26	$500,650	0.262	$131,076
	d	afy	0	31000	31000	$314	$9,748,570	0.262	$2,552,292
2033	a	kW	0	16175512	16175512	$0	$1,294,041	0.247	$319,618
	b	tons/yr	0	500	500	$26	$13,175	0.247	$3,254
	c	tons/yr	0	19000	19000	$26	$500,650	0.247	$123,657
	d	afy	0	31000	31000	$314	$9,748,570	0.247	$2,407,822
2034	a	kW	0	16175512	16175512	$0	$1,294,041	0.233	$301,527
	b	tons/yr	0	500	500	$26	$13,175	0.233	$3,070
	c	tons/yr	0	19000	19000	$26	$500,650	0.233	$116,657
	d	afy	0	31000	31000	$314	$9,748,570	0.233	$2,271,531
2035	a	kW	0	16175512	16175512	$0	$1,294,041	0.220	$284,459
	b	tons/yr	0	500	500	$26	$13,175	0.220	$2,896
	c	tons/yr	0	19000	19000	$26	$500,650	0.220	$110,054
	d	afy	0	31000	31000	$314	$9,748,570	0.220	$2,142,953
2036	a	kW	0	16175512	16175512	$0	$1,294,041	0.207	$268,358
	b	tons/yr	0	500	500	$26	$13,175	0.207	$2,732
	c	tons/yr	0	19000	19000	$26	$500,650	0.207	$103,825
	d	afy	0	31000	31000	$314	$9,748,570	0.207	$2,021,654
2037	a	kW	0	16175512	16175512	$0	$1,294,041	0.196	$253,168
	b	tons/yr	0	500	500	$26	$13,175	0.196	$2,578
	c	tons/yr	0	19000	19000	$26	$500,650	0.196	$97,948
	d	afy	0	31000	31000	$314	$9,748,570	0.196	$1,907,221
2038	a	kW	0	16175512	16175512	$0	$1,294,041	0.185	$238,837
	b	tons/yr	0	500	500	$26	$13,175	0.185	$2,432
	c	tons/yr	0	19000	19000	$26	$500,650	0.185	$92,404
	d	afy	0	31000	31000	$314	$9,748,570	0.185	$1,799,265
2039	a	kW	0	16175512	16175512	$0	$1,294,041	0.174	$225,318
	b	tons/yr	0	500	500	$26	$13,175	0.174	$2,294
	c	tons/yr	0	19000	19000	$26	$500,650	0.174	$87,173
	d	afy	0	31000	31000	$314	$9,748,570	0.174	$1,697,420
2040	a	kW	0	16175512	16175512	$0	$1,294,041	0.164	$212,564
	b	tons/yr	0	500	500	$26	$13,175	0.164	$2,164
	c	tons/yr	0	19000	19000	$26	$500,650	0.164	$82,239
	d	afy	0	31000	31000	$314	$9,748,570	0.164	$1,601,339
2041	a	kW	0	16175512	16175512	$0	$1,294,041	0.155	$200,532
	b	tons/yr	0	500	500	$26	$13,175	0.155	$2,042
	c	tons/yr	0	19000	19000	$26	$500,650	0.155	$77,584
	d	afy	0	31000	31000	$314	$9,748,570	0.155	$1,510,698
2042	a	kW	0	16175512	16175512	$0	$1,294,041	0.146	$189,182
	b	tons/yr	0	500	500	$26	$13,175	0.146	$1,926
	c	tons/yr	0	19000	19000	$26	$500,650	0.146	$73,192
	d	afy	0	31000	31000	$314	$9,748,570	0.146	$1,425,186
2043	a	kW	0	16175512	16175512	$0	$1,294,041	0.138	$178,473
	b	tons/yr	0	500	500	$26	$13,175	0.138	$1,817

Table 16 - Water Quality and Other Expected Benefits (All benefits should be in 2009 dollars) Project (b) Sludge Dewatering, Odor Control, and Primary Sludge Thickening (OCSD)									
(a)	(b)	(c)	(d)	(e)	(f)	(g)	(h)	(i)	(j)
Year	Type of Benefit	Measure of Benefit (Units)	Without Project	With Project	Change Resulting from Project (e) – (d)	Unit $ Value (1)	Annual $ Value (f) x (g) (1)	Discount Factor (1)	Discounted Benefits (h) x (i) (1)
	c	tons/yr	0	19000	19000	$26	$500,650	0.138	$69,049
	d	afy	0	31000	31000	$314	$9,748,570	0.138	$1,344,515
2044	a	kW	0	16175512	16175512	$0	$1,294,041	0.130	$168,371
	b	tons/yr	0	500	500	$26	$13,175	0.130	$1,714
	c	tons/yr	0	19000	19000	$26	$500,650	0.130	$65,141
	d	afy	0	31000	31000	$314	$9,748,570	0.130	$1,268,411
2045	a	kW	0	16175512	16175512	$0	$1,294,041	0.123	$158,840
	b	tons/yr	0	500	500	$26	$13,175	0.123	$1,617
	c	tons/yr	0	19000	19000	$26	$500,650	0.123	$61,454
	d	afy	0	31000	31000	$314	$9,748,570	0.123	$1,196,614
2046	a	kW	0	16175512	16175512	$0	$1,294,041	0.116	$149,850
	b	tons/yr	0	500	500	$26	$13,175	0.116	$1,526
	c	tons/yr	0	19000	19000	$26	$500,650	0.116	$57,975
	d	afy	0	31000	31000	$314	$9,748,570	0.116	$1,128,881
2047	a	kW	0	16175512	16175512	$0	$1,294,041	0.109	$141,367
	b	tons/yr	0	500	500	$26	$13,175	0.109	$1,439
	c	tons/yr	0	19000	19000	$26	$500,650	0.109	$54,693
	d	afy	0	31000	31000	$314	$9,748,570	0.109	$1,064,982
2048	a	kW	0	16175512	16175512	$0	$1,294,041	0.103	$133,366
	b	tons/yr	0	500	500	$26	$13,175	0.103	$1,358
	c	tons/yr	0	19000	19000	$26	$500,650	0.103	$51,598
	d	afy	0	31000	31000	$314	$9,748,570	0.103	$1,004,700
2049	a	kW	0	16175512	16175512	$0	$1,294,041	0.097	$125,817
	b	tons/yr	0	500	500	$26	$13,175	0.097	$1,281
	c	tons/yr	0	19000	19000	$26	$500,650	0.097	$48,677
	d	afy	0	31000	31000	$314	$9,748,570	0.097	$947,830
2050	a	kW	0	16175512	16175512	$0	$1,294,041	0.092	$118,695
	b	tons/yr	0	500	500	$26	$13,175	0.092	$1,208
	c	tons/yr	0	19000	19000	$26	$500,650	0.092	$45,922
	d	afy	0	31000	31000	$314	$9,748,570	0.092	$894,180
2051	a	kW	0	16175512	16175512	$0	$1,294,041	0.087	$111,976
	b	tons/yr	0	500	500	$26	$13,175	0.087	$1,140
	c	tons/yr	0	19000	19000	$26	$500,650	0.087	$43,322
	d	afy	0	31000	31000	$314	$9,748,570	0.087	$843,566
2052	a	kW	0	16175512	16175512	$0	$1,294,041	0.082	$105,638
	b	tons/yr	0	500	500	$26	$13,175	0.082	$1,076
	c	tons/yr	0	19000	19000	$26	$500,650	0.082	$40,870
	d	afy	0	31000	31000	$314	$9,748,570	0.082	$795,817
2053	a	kW	0	16175512	16175512	$0	$1,294,041	0.077	$99,658
	b	tons/yr	0	500	500	$26	$13,175	0.077	$1,015
	c	tons/yr	0	19000	19000	$26	$500,650	0.077	$38,557
	d	afy	0	31000	31000	$314	$9,748,570	0.077	$750,770
2054	a	kW	0	16175512	16175512	$0	$1,294,041	0.073	$94,017
	b	tons/yr	0	500	500	$26	$13,175	0.073	$957
	c	tons/yr	0	19000	19000	$26	$500,650	0.073	$36,374
	d	afy	0	31000	31000	$314	$9,748,570	0.073	$708,274
2055	a	kW	0	16175512	16175512	$0	$1,294,041	0.069	$88,696
	b	tons/yr	0	500	500	$26	$13,175	0.069	$903
	c	tons/yr	0	19000	19000	$26	$500,650	0.069	$34,315
	d	afy	0	31000	31000	$314	$9,748,570	0.069	$668,183
2056	a	kW	0	16175512	16175512	$0	$1,294,041	0.065	$83,675
	b	tons/yr	0	500	500	$26	$13,175	0.065	$852
	c	tons/yr	0	19000	19000	$26	$500,650	0.065	$32,373
	d	afy	0	31000	31000	$314	$9,748,570	0.065	$630,361
2057	a	kW	0	16175512	16175512	$0	$1,294,041	0.061	$78,939
	b	tons/yr	0	500	500	$26	$13,175	0.061	$804
	c	tons/yr	0	19000	19000	$26	$500,650	0.061	$30,541

Table 16 - Water Quality and Other Expected Benefits

(All benefits should be in 2009 dollars)

Project (b) Sludge Dewatering, Odor Control, and Primary Sludge Thickening (OCSD)

(a) Year	(b) Type of Benefit	(c) Measure of Benefit (Units)	(d) Without Project	(e) With Project	(f) Change Resulting from Project (e) – (d)	(g) Unit $ Value (1)	(h) Annual $ Value (f) x (g) (1)	(i) Discount Factor (1)	(j) Discounted Benefits (h) x (i) (1)
	d	afy	0	31000	31000	$314	$9,748,570	0.061	$594,680
2058	a	kW	0	16175512	16175512	$0	$1,294,041	0.058	$74,471
	b	tons/yr	0	500	500	$26	$13,175	0.058	$758
	c	tons/yr	0	19000	19000	$26	$500,650	0.058	$28,812
	d	afy	0	31000	31000	$314	$9,748,570	0.058	$561,019
2059	a	kW	0	16175512	16175512	$0	$1,294,041	0.054	$70,255
	b	tons/yr	0	500	500	$26	$13,175	0.054	$715
	c	tons/yr	0	19000	19000	$26	$500,650	0.054	$27,181
	d	afy	0	31000	31000	$314	$9,748,570	0.054	$529,264
2060	a	kW	0	16175512	16175512	$0	$1,294,041	0.051	$66,279
	b	tons/yr	0	500	500	$26	$13,175	0.051	$675
	c	tons/yr	0	19000	19000	$26	$500,650	0.051	$25,642
	d	afy	0	31000	31000	$314	$9,748,570	0.051	$499,305
2061	a	kW	0	16175512	16175512	$0	$1,294,041	0.048	$62,527
	b	tons/yr	0	500	500	$26	$13,175	0.048	$637
	c	tons/yr	0	19000	19000	$26	$500,650	0.048	$24,191
	d	afy	0	31000	31000	$314	$9,748,570	0.048	$471,043
2062	a	kW	0	16175512	16175512	$0	$1,294,041	0.046	$58,988
	b	tons/yr	0	500	500	$26	$13,175	0.046	$601
	c	tons/yr	0	19000	19000	$26	$500,650	0.046	$22,822
	d	afy	0	31000	31000	$314	$9,748,570	0.046	$444,380
2063	a	kW	0	16175512	16175512	$0	$1,294,041	0.043	$55,649
	b	tons/yr	0	500	500	$26	$13,175	0.043	$567
	c	tons/yr	0	19000	19000	$26	$500,650	0.043	$21,530
	d	afy	0	31000	31000	$314	$9,748,570	0.043	$419,226
2064	a	kW	0	16175512	16175512	$0	$1,294,041	0.041	$52,499
	b	tons/yr	0	500	500	$26	$13,175	0.041	$535
	c	tons/yr	0	19000	19000	$26	$500,650	0.041	$20,311
	d	afy	0	31000	31000	$314	$9,748,570	0.041	$395,496
2065	a	kW	0	16175512	16175512	$0	$1,294,041	0.038	$49,527
	b	tons/yr	0	500	500	$26	$13,175	0.038	$504
	c	tons/yr	0	19000	19000	$26	$500,650	0.038	$19,162
	d	afy	0	31000	31000	$314	$9,748,570	0.038	$373,110
Project Life								…	
Total Present Value of Discounted Benefits Based on Unit Value (Sum of the values in Column (j) for all Benefits shown in table) Transfer to Table 20, column (f), Exhibit F: Proposal Costs and Benefits Summaries									136563694.9

Comments: Energy savings calculations are based on OCSD's Power Model.

Greenhouse gas emissions calculations are based on the reduction of trucks needed to haul a dryer byproduct versus the reduction of green house gas produced to transport imported water to the region.

Improved water quality is based on lower Total Dissolved Solids (TDS), TDS is based on the GWRS recycled water lower TDS levels compared to TDS levels of imported water. $0.413 per 1999 report, 1.29 update factor to convert from 1999 to 2009 dollars.

(1) Complete these columns if dollar value is being claimed for the benefit.

a Energy Savings = 22.98 kscf/MG × 34 mgd × 365 days × 56.72 kWh/kscf

b Green House Gases - reduced truck loads of solids = 500 tons/yr × $50 per year (estimated for 2035) × 0.220

c Green House Gases - imported water = 19,000 tons/yr × $50 per year (estimated for 2035) × 0.220

d Lower TDS levels = 31,000 afy × 590 mg/L × $0.413 mg/L/afy (per report dated 1999) × 1.29

GHG Analysis for Solids on P1-101

P1-101 Results

Parameter	Value	
Projected change in percent solids from P1-101	10%	
Estimated 2012 BFP tons per day	700	
Estimated 2012 centrifuge tons per day	500	(every 10% change in water results in about :
Biosolids tons per truck	25	
Less trucks with centrifuges	8	
One-way Miles to Kern Site	200	
Round trip miles	400	
Avoided truck miles per day with centrifuges	3200	
Truck miles to diesel gallon	5	
Diesel gallons avoided per day	640	
Diesel gallons produced per barrel of oil	7	
Barrels of oil avoided per day	**91.4**	

P1-101 Demands

Parameter	Value
Power usage for dewatering centrifuges (kW)	5000
Power generated per barrel of oil (kW-hr)	1700
Hours per day	24
Barrels of oil used per hour	2.9
Barrels of oil used per day	**70.6**

Barrel of oil CO_2 eq	317	kg
P1-101 CO_2 Reductions	28982.86	kg/d
P1-101 CO_2 Increases	22376.47	kg/d
Net P1-101 Savings	6606.387	kg/d
Annual P1-101 Net Savings (metric)	**2,411,331**	**kg/yr**
Annual P1-101 Net Savings (english)	**1,094,567**	**lbs/yr**
Annual P1-101 Net Savings (english)	**547**	**tons/yr**

25% change in weight)

blend of water into basin with GWR

	tds	flow afy	
SAR	625	123000	76875000
SAR Storm	400	75000	30000000
Incidental	800	70000	56000000
GWR Anaheim	65	42000	2730000
SWP	250	9000	2250000
CRW	700	9000	6300000
GWR Talbert	65	36000	2340000
Alamitos	550	2000	1100000
blended	485	366000	177595000

Master Plan Balance

SAR	625	123000	76875000
SAR Storm	400	75000	30000000
Incidental	800	70000	56000000
SWP	250	43000	10750000
CRW	700	43000	30100000
Talbert	450	10000	4500000
Alamitos	550	2000	1100000
blended	572	366000	209325000

MET service area benefit on /af basis

afy	$	mg/l	benefit $/mg/l/af
2300000	95000000	100	0.413

OCWD BPP Benefit based on MET Value

existing blend	572
future blend	485
reduction	87

flow afy	tds reduction mg/l	benefit $/mg/l/afy	total value each year $
366000	87	0.413	13,105,870

OCSD PLANT NO. 1 SLUDGE AND GAS PRODUCTION

Additional wastewater treatment	34	mgd
Additional sludge treatment	**42500**	**cf/day**
Additional gas generated	781	kcf/day
Additional electricity generated	**44300**	**kW/day**

PLANT # 1 Data July 2008 thru June 2009

	Average Daily Wastewater Influent (MGD)	Average Daily Sludge Production (cf/day)	Sludge Production per MG Wastewater Influent (cf/MG)	Average Daily Gas Production (kcf/day)	Gas Production per MG Wastewater Influent (kcf/MG)	Elect. Generated (kwh)	Digester gas usage			
							Quanity (kscf)	H.H.V. (Btu/cu.ft)	Heat Value (therms)	kWh/kscf
Jul 08	90	110352	1226	2074	23.0	2,977,019	51,339	630	323,436	57.99
Aug	89	108730	1222	2072	23.3	3,008,000	52,581	623	327,580	57.21
Sep	88	106888	1215	2035	23.1	2,944,000	51,597	626	322,997	57.06
Oct	86	109149	1269	2065	24.0	3,008,000	52,916	631	333,900	56.84
Nov	85	106118	1248	2006	23.6	2,864,000	50,683	624	316,262	56.51
Dec	84	106240	1265	2021	24.1	3,256,000	55,913	629	351,693	58.23
Jan 09	81	111235	1373	2077	25.6	3,456,000	57,627	632	364,203	59.97
Feb	84	116318	1385	2105	25.1	2,928,854	51,953	629	326,784	56.38
Mar	83	108372	1306	1971	23.7	2,544,065	57,175	632	361,346	44.50
Apr	83	97766	1178	1654	19.9	2,819,988	50,239	635	319,018	56.13
May	83	101027	1217	1755	21.1	3,065,190	50,440	634	319,790	60.77
Jun	98	107325	1095	1877	19.2	3,061,538	51,019	637	324,991	60.01
TOTAL			**1250**		**22.9828**	35,932,654	633,482		3,991,998	56.72

WHITE PAPER
ON
ECONOMIC BENEFITS
OF
GROUNDWATER REPLENISHMENT SYSTEM
(Final, April 20, 1998)

Summary

In response to projections of future droughts and water shortages, the Orange County Water District (OCWD) and the County Sanitation Districts of Orange County (CSDOC) have been evaluating alternatives for increasing local water supplies. The Groundwater Replenishment System is the result of five years of planning and analysis. It is believed that the Groundwater Replenishment System is the most economical and feasible water supply alternative available and offers many benefits in addition to providing a safe, reliable, new water source. If implemented, the Groundwater Replenishment System delays and in some instances eliminates the need for necessary infrastructure, provides water quality benefits to those who use the groundwater, and reduces the need to purchase uncertain imported water. The cost of the most likely project alternative including capital amortization, operation and maintenance is estimated to be approximately $36.7 million per year. However, the savings from the benefits are estimated to be at least $44 million per year.

It is difficult to determine the exact economic value of a water recycling project because many of its benefits are societal and environmental which go beyond economics. This White Paper does not present a complete resource analysis, but does attempt to identify and quantify some of the more obvious benefits of the Groundwater Replenishment System.

Introduction

Southern California and much of the southwestern portion of the United States experience water shortages and are dependent on increasingly less reliable imported water supplies. Finding new sources of imported water holds little promise and recent federal watershed policy and court actions continue to reduce the reliability of imported water. A demographics study completed by California State University at Fullerton has projected that the population in Orange County will increase by approximately 1.2 million and 800,000 of those additional people will be dependent on the groundwater basin managed by OCWD. These significant population increases will tax existing water supplies and surpass availability during drought conditions. Therefore, enhancing available water supplies is required to sustain Orange County's current economy and lifestyle. The Groundwater Replenishment System is a proposed local water supply project sponsored jointly by the Orange County Water District (OCWD) and the County Sanitation Districts of Orange County (CSDOC). Water reclamation is currently the most productive method to help meet future water needs and to provide a safe and reliable local water supply. The Groundwater Replenishment System, if implemented, will ultimately provide 100,000 acre-feet of new, drinkable water each year, enough water to supply 200,000 families.

Traditionally, cost comparisons for new projects are made against costs of existing projects or alternative projects and against the benefits received. For the Groundwater Replenishment System, a cost comparison of the product water that includes capital amortization, operations and maintenance costs, has been made against the projected cost of importing additional water and other local options such as seawater desalination. However, past studies have not included the benefits that will result if the Groundwater Replenishment System is implemented.

Presented in the paragraphs below are the capital costs of the Groundwater Replenishment System and the secondary economic benefits that will result if the Groundwater Replenishment System is implemented.

Capital Costs

Comment [es1]:

The capital costs of the water produced by the Groundwater Replenishment System are dependent on many factors including regulatory permit requirements, equipment and construction costs, power costs, operation and maintenance costs, system on-line reliability requirements, interest rates, and grants received from outside agencies.

A preliminary cost estimate was prepared by OCWD and CSDOC Staff and has also been verified by an outside independent consultant. The capital costs presented below are for Phase 1 of the Groundwater Replenishment System and are the costs of the most probable alternative to date.

Capital Costs	$278 Million
Operation & Maintenance	$15 Million/year
Interest	6% amortized over 25 years
Power Cost	$0.06/kwh
Utilization	100% Barrier; 82% Spreading
Engineering/Admin.	15% of construction costs
Contingencies	20% of capital costs
Cost of Product Water	$555/AF

The utilization factor presented above is the actual amount of time water will be produced for the barrier and spreading which affects the unit cost of the water. It is anticipated that the barrier will be on line 100% of the year and water will be produced for the spreading basins all year with the exception of 70 days during the winter months when the basins may not be able to accept water.

It should be noted that the unit costs used to estimate the above capital costs were purposely conservative and may not reflect actual economies that a project of this size may generate. For example, both CSDOC and OCWD are able to borrow money at lower interest rates than 6%; and as of the date of this paper, a more realistic rate would be approximately 3%. The cost of power is also expected to be significantly lower than $0.06 per kwh after deregulation. Finally, 38% was included for engineering, administration and contingencies which totals approximately $74 million and is believed to be extremely conservative. All of these estimates were conservative to ensure that the estimated cost of the product water was not underestimated.

Project Benefits

The benefits of the Groundwater Replenishment System include delay and/or avoided costs for funding significant infrastructure that will be needed by both OCWD and CSDOC if the Groundwater Replenishment System is not implemented, improvements to the overall water quality in the groundwater basin, and improvements in supply reliability, specifically during drought conditions. A more detailed explanation of these benefits and their economic values are described below.

1. <u>OCWD Cost Avoidance</u>

    If the Groundwater Replenishment System is not implemented, there are a variety of alternatives that could be pursued to make up the shortfall assuming that imported water is available at a noninterruptible rate. Presented below are three alternatives that may be pursued.

    <u>Alternative 1:</u>

    This alternative assumes that if the Groundwater Replenishment System is not implemented, Water Factory 21 will be repaired to continue to operate at its existing capacity of 15 mgd and the additional water needed for injection would be imported water. This alternative would also require the construction of a pipeline from MWD's lower inland feeder to OCWD's site in Fountain Valley. This alternative assumes that water needed for spreading would also be purchased from MWD and would require the construction of a pipeline from MWD's Diemer by pass pipeline to the spreading facilities in Anaheim. The annual costs that OCWD will avoid for Alternative 1 if the Groundwater Replenishment System is implemented is as follows:

Table 1
Alternative 1

Item	[1]Annual Cost Avoidance (Millions $)
Repair WF 21 to Operate at Current Capacity	$0.9
Annual O&M	$7.7
Construct Pipeline from Lower Feeder	$1.2
Construct Pipeline from Diemer Bypass	$0.3
Purchase Imported Water for Additional Injection	$4.8[2]
Purchase Imported Water for Spreading	$11.7[3]
OCWD Annual Cost Avoidance - Alternative 1	**$26.6**

1. Annual costs were calculated using an interest rate of 6% amortized over a 25 year period.
2. Cost to purchase 9,000 afy of imported water at MWD's current treated noninterruptible rate of $533/af.
3. Cost to purchase 43,000 afy of imported water at MWD's current seasonal untreated water rate of $272/AF.

Provided that imported water is available, the equivalent unit cost to implement Alternative 1 would be $644/AF.

<u>Alternative 2:</u>

Alternative 2 assumes that if the Groundwater Replenishment System is not implemented then Water Factory 21 will be expanded to provide all the water needed for groundwater injection to continue to protect the existing groundwater basin from seawater intrusion. This alternative also assumes that water needed for spreading would be purchased from MWD and would require the construction of a pipeline from MWD's Diemer by-pass pipeline to the spreading facilities in Anaheim.

The annual costs that OCWD will avoid for Alternative 2 if the Groundwater Replenishment System is implemented is as follows:

Table 2
Alternative 2

Item	[1]**Annual Cost Avoidance** (Millions $)
Expand WF-21	$3.9
O& M Reduction	$7.7
Construct Pipeline from Diemer Bypass	$0.3
Purchase Imported Water for Spreading	$11.7[2]
OCWD Annual Cost Avoidance - Alternative 2	**$23.6**

1. Annual costs were calculated using an interest rate of 6% amortized over a 25 year period.
2. Cost to purchase 43,000 afy of imported water at MWD's current seasonal untreated water rate of $272/AF.

Provided that imported water is available, the equivalent unit cost to implement Alternative 2 would be $599/AF.

<u>Alternative 3:</u>

Alternative 3 assumes that the Groundwater Replenishment System is not implemented and Water Factory 21 is taken off line and all water for injection and spreading will be available from MWD. If this were the alternative of choice, a pipeline from MWD's lower inland feeder to OCWD would be required for injection water as well as a pipeline from the Diemer bypass for spreading water.

The annual costs that OCWD will avoid for Alternative 3 if the Groundwater Replenishment System is implemented is as follows:

Table 3
Alternative 3

Item	[1]**Annual Cost Avoidance** (Millions $)
Purchase Imported Water for Injection	$12.8[2]
Construct Pipeline from Diemer Bypass	$0.3
Purchase Imported Water for Spreading	$11.7[3]
Construct Pipeline from Inland Feeder	$1.2
OCWD Annual Cost Avoidance - Alternative 3	**$26.0**

1. Annual costs were calculated using an interest rate of 6% amortized over a 25 year period.
2. Cost to purchase 24,000 afy of imported water at MWD's current treated noninterruptible rate of $533/af.
3. Cost to purchase 43,000 afy of imported water at MWD's current seasonal untreated water rate of $272/AF.

Provided that imported water is available, the equivalent unit cost to implement Alternative 3 would be $635/AF.

2. Salinity Management

As described below, water quality in the OCWD's service area suffers from higher than desired total dissolved solids (TDS) levels (for the purpose of this discussion, TDS and salinity are used interchangeably). High TDS water requires additional treatment to remove the salts prior to use by agriculture; households; water and wastewater utility systems; and industrial facilities. If the salinity is not dealt with, agricultural water users suffer economic damage through reduced crop yields, added labor costs for irrigation management, and added drainage requirements. Urban users incur additional costs due to more frequent replacement of plumbing and water using appliances; use of water softeners; or the purchase of bottled water or home water filters. In 1986, the US Bureau of Reclamation estimated that the total cost to a household from high TDS water ranged from $66.00 to $134.00 per year (in 1986 dollars). TDS levels in the OCWD service area are comparable. Costs for regulation, agriculture and industry charges would add to this cost. After an allowance for inflation, present day costs could range from $100.00 to $150.00 per year per household. Since a household uses ½ acre-foot of water per year, the cost of the higher salinity water is at least $200.00 to $300.00 per acre-foot. Industries, water and wastewater utilities incur additional costs due to higher levels of salinity because there is a reduction in useful life and system facilities and equipment must be replaced at a more rapid rate. Additional costs are also incurred due to regulatory restrictions imposed by regional water quality standards and management programs to protect groundwater supplies.

The Groundwater Replenishment System service area receives water from the Santa Ana River (SAR) and imported water from the Colorado River Aqueduct (CRA) and the State Water Project (SWP). The first two sources of water have high TDS levels. The highest TDS water is the SAR water. The base flow in the SAR is largely secondary effluent from wastewater treatment plants that discharge upstream. Water received from the Colorado River Aqueduct is also high in salinity. SWP water is of very high quality, but it does not make up a high enough percentage of the total water used to counter-act the two high salinity sources. Therefore, the quality of Orange County's groundwater is mostly dependent on the quality of the SAR water and water from the CRA. The water quality pumped from the groundwater basin currently reflects the higher salinity levels, with total dissolved solid levels generally above 600 mg/l. The Regional Water Quality Control Board has set a recharge goal of 600 mg/l of TDS. USEPA and many health agencies use a level of 500 mg/l TDS as a recommended drinking water standard.

The Groundwater Replenishment System will provide a higher quality water (lower Salinity and TDS levels) than the other water sources. This will result in lowering the overall TDS content of the groundwater basin. Since the Groundwater Replenishment System water will provide about 15% of the future total water supply, and the current blend averages approximately 600 mg/l, the quality of the new water mix will be lowered by at least 12.5 percent. This should save the average household approximately $12.50 per year (or $25 per acre-foot), with correspondingly significant increases in savings for industrial and other large water users. With a total water use of 650,000 afy in the year 2020, this provides an annual benefit of $16.3 million.

3. Reliability

Availability of imported water supplies from the (CRA) and the (SWP) are very uncertain. Allocations from the CRA are already overextended and if all eligible users took their allotted quantity of water, many areas would suffer water shortages. During drought conditions the situation worsens. As the population in north and central Orange County increases, there will be an increase in water demands. It is currently projected that approximately 150,000 afy of additional water will be required by the year 2020 to satisfy OCWD's service area demands. If implemented, the Groundwater Replenishment System would be capable of supplying two-thirds (100,000 afy) of that projected increase in demand.

The water supplied from the Groundwater Replenishment System would be drought resistant, meaning it would be available during times of drought. Therefore, OCWD and CSDOC would not be as dependent on imported water supplies to satisfy the needs of Orange County water users. In addition, the Groundwater Replenishment System would protect the existing groundwater from further seawater intrusion and contamination. The value of this benefit is dependent on both drought frequency and job mix. Therefore, while it is important, we have not attempted to quantify the value.

4. CSDOC Cost Avoidance

The Groundwater Replenishment System, as proposed, will be able to divert 100 million gallons per day (mgd) from the Sanitation Districts Ocean Outfall Disposal System. During peak wet weather events, the Districts' Strategic Plan predicts wet weather peaks of about 750 mgd while the ocean disposal system capacity is approximately 480 mgd. To make up for this shortfall, the CSDOC Strategic Plan is considering a variety of options including use of existing standby disposal facilities, retarding flows (peak shaving), and inflow reduction techniques to delay the near-term cost of constructing a second ocean outfall. In addition, the most significant way to reduce the peak is the diversion of 100 mgd through the Groundwater Replenishment System. Using the Groundwater Replenishment System for this diversion slightly raises the capital cost of the project.

The cost of the outfall, estimated at $150 million, can be delayed at least ten years by application of several peak reduction methods including this project. If one assumes that half of that delay is due to the Groundwater Replenishment System (5 years), the savings at 6% interest spread over 20 years gives a $4 million per year benefit.

CSDOC currently has a waiver under Section 301 (h) of the Clean Water Act from the requirement to discharge effluent that has received full secondary treatment. This waiver was granted because of the high quality of CSDOC's effluent, and recognition of their highly praised source control compliance program which helps to limit toxins discharged to the ocean. CSDOC's wavier is the largest granted by the USEPA and in 1989 was estimated to save over $50 million per year in capital, operation and maintenance charges. Protection of this waiver is of the highest priority to CSDOC.

CSDOC's active participation in the Groundwater Replenishment System results in less discharge into the ocean as well as less surge flows during storms. Use of CSDOC funds in reclamation, such as this project, is supported by State and Federal agencies. It appears that a commitment to water reclamation will complement CSDOC's request for future waivers from secondary discharge requirements. A strong argument can be made that support of the Groundwater Replenishment System supports renewal of the waiver; however, the degree to which savings can be attributed to the Groundwater Replenishment System is difficult. If for example, the Groundwater Replenishment System accounted for 20% of the savings, the project could be credited with $10 million per year in cost avoidance. However, no credit is taken for this project benefit.

The 1998 ocean discharge permit allows a discharge of 20,000 metric tons (MT) per year of suspended solids, and includes a reopener if the Groundwater Replenishment System is built. If a new permit is granted allowing 25,000 MT per year discharge, the savings by delaying in the building of new secondary facilities (10 years), and the savings in O&M including solids disposal, all amortized at 6% interest and 20 year term, is $11 million per year. However, we have not included these savings in our evaluation.

Conclusion

The annual cost to implement the Groundwater Replenishment System, including capital, operation and maintenance, engineering, administration and contingencies at 6% interest and amortized over a 25 year period would be approximately $36.7 million. The annual benefits are as follows:

Item	Total Annual Cost Avoidance (Millions $)
OCWD Cost Avoidance	$23.6
Salinity Management	$16.3
Reliability	Not Counted
CSDOC, Delay in Outfall	$4.0
CSDOC, Waiver Support	Not Counted
CSDOC, Secondary Savings	Not Counted
TOTAL	**$43.9**

This results in a maximum Benefit to Cost Ratio of 1.20 ($43.9 / $36.7).

White Paper

ECONOMIC BENEFITS

OF THE

Groundwater Replenishment System

Prepared For:

ORANGE COUNTY
WATER DISTRICT

Prepared By:

Virginia Grebbien, P.E.
Richard W. Atwater

December 20, 1999

INTRODUCTION

The Groundwater Replenishment System (GWR System) has multiple benefits. In this paper the authors have documented the benefits of the project and to the degree possible, we have quantified the benefits in dollar terms. However, some of the benefits are difficult to describe in monetary terms and, therefore, are identified in a descriptive manner.

The purpose of the paper is to describe the benefits only. The comparison of the benefits to the costs (e.g., a cost benefit evaluation) of the GWR System was not performed. Nor was the relative cost effectiveness of alternative project configurations analyzed.

The benefits of the GWR System are estimated from five perspectives:

1) Orange County Sanitation Districts' wastewater treatment and ocean disposal perspective;

2) Orange County Water District's water supply and groundwater management perspective;

3) Regional water supply perspective;

4) Santa Ana River Watershed benefits of improving the water quality of the flow below Prado Dam;

5) Statewide benefits of improving the water reliability of the State Water Project and assisting in the California 4.4 Plan by reducing the southern California dependence on imported water supplies (and thereby assisting in CALFED Bay-Delta and Colorado River environmental solutions).

The incremental benefits of the GWR System water recycling project are the basis of the analysis. Incremental benefits do not include the future benefits that would occur even if the project were not implemented.

Project Description

The Orange County Water District (OCWD) and the Orange County Sanitation Districts (OCSD) are developing the GWR System jointly. The objective of GWR System is to develop a new recycled water supply to increase the quality and reliability of replenishing the Orange County groundwater basin. Replenishment would be accomplished through both injection at the Talbert Gap barrier and through spreading in the Anaheim Forebay at the OCWD spreading facilities. The GWR System would ultimately produce approximately 120,000 acre-feet of high quality membrane treated recycled water for replenishment of the Orange County groundwater basin. In addition, it is contemplated the project will provide recycled water for direct use by both industry and landscape irrigation applications.

The GWR System product water will be used to augment the recharge operations at the Anaheim Forebay recharge facilities, the Talbert Gap seawater intrusion barrier served by Water Factory 21 (WF-21) and the Green Acres Project (GAP), which supplies recycled water to industrial and landscape irrigation customers. It is estimated that the project will be built in three phases.

Flow and Quantities of Recycled Water		
Phase I:	Forebay recharge	42,770 AF/Y
	Talbert GAP	23,830 AF/Y
Phase II:	Forebay Recharge	69,929 AF/Y
	Talbert GAP	23,830 AF/Y
Phase III:	Forebay Recharge	97,000 AF/Y
	Talbert GAP	23,830 AF/Y

GWR System water will be produced at the site of WF-21 and the OCSD Plant No. 1, located in Fountain Valley. The project water will be delivered through a 13-mile pipeline to the Anaheim Forebay recharge facilities along the Santa Ana River right of way. In addition, a series of new injection wells along the Talbert Gap will be constructed to augment the existing seawater barrier well field to inject additional recycled water into the Talbert seawater intrusion barrier project.

The Green Acres Project (GAP) currently provides about 7,000 AFY of recycled water (Title 22 tertiary filtered water) to industrial and landscape customers in the cities of Fountain Valley, Santa Ana and Costa Mesa. The planned expansion of the GAP would serve the cities of Newport Beach and Huntington Beach. In addition, potential recycled water customers along the Santa Ana River are being investigated to determine their desirability for recycled water use. Industrial customers are particularly suited for the high quality water that will be produced by the GWR System.

The authors recognize the very recent discussions regarding the potential revisions to the overall cost and scope of the project. For that reason the authors have made no attempt to document GWR System capital costs or estimated operation and maintenance costs. Cost issues are outside the scope of discussion of this paper. For purposes of this paper the authors have assumed that the project will remain fundamentally a replenishment project, recharging the groundwater basin in the Anaheim Forebay area and serve as a source of supply for the Talber Barrier sweater intrusion project. The ultimate project yield of the GWR System will be on the order of magnitude of 120,000 AFY.

Direct Project Benefits

Water Supply

The GWR System will provide new water supplies to Orange County. OCWD must secure a greater amount of replenishment and firm water supplies in order to maintain the basin production percentage at the 75 percent range and meet the demand of future growth on groundwater supplies. OCWD currently estimates the need for additional replenishment water to be 127,000 AFY by 2020 (OCWD Master Plan, April 1999). Development of the GWR System replenishment supply avoids placing a demand upon the Metropolitan Water District in the future for the required replenishment supplies.

The current cost of these supplies from Metropolitan is $233/AF (Seasonal Storage Service, untreated) and $431/AF (firm basic service, treated) respectively. In addition to the Metropolitan rate, surcharges result in a melded cost to OCWD for Forebay recharge water of $299/AF and barrier injection water for the Talbert Gap of $506/AF. Metropolitan projects its rates will experience only minor increases over the next ten years (about 1 percent per year). However, Metropolitan is simultaneously undergoing a Strategic Planning and Rate Refinement process. As a result, it is not currently possible to accurately state the avoided cost of purchasing water from Metropolitan. There is significant potential for a revised rate structure that would consist of a series of fixed and variable fees.

If one were to assume the status quo in the Metropolitan rate structure, the avoided cost of purchasing replenishment and barrier water from Metropolitan could be calculated. Phase I of the GWR System enables OCWD to avoid purchasing up to 66,600 AFY of replenishment water for both the Anaheim Forebay and the Talbert Barrier. The avoided cost would be about $24,800,000 per year ($299/AF x 42,770 AFY Anaheim Forebay water plus $506/AF x 23,830 AFY Talbert Barrier water). However, as cautioned above this is a placeholder number only and one would need to revise this calculation at the conclusions of the Metropolitan Rate Refinement process. In addition, Metropolitan is considering a new policy of requiring long-term contracts for groundwater replenishment. The terms and conditions of those potential contracts and their associated costs and benefits are not currently known.

Salinity Reduction/Long-Term Salt Balance of Orange County Basin

Increasing salinity is a significant water quality issue for the Orange County groundwater basin. Previous studies by OCWD have confirmed there is a salt imbalance within OCWD's service area. Prior water quality reviews show increasing salinity in production wells and that the basin has no assimilative capacity for additional salts. The basin is experiencing a greater inflow of high salinity water and lack of salt removal that has led to increasing salt concentrations.

An internal OCWD memo written in August 1999 calculated the GWR System would reduce the salinity of replenishment water supply by about 132 mg/L. This calculation assumes the average TDS level in the basin is 600 mg/L, GWR System water would have a TDS level of 50 mg/L and 120,000 AFY project yield.

The Metropolitan Water District and United States Bureau of Reclamation recently completed a comprehensive Salinity Management Study (Final Report June 1999). The study documents the numerous benefits of reduced salinity in water supplies. The GWR System reduces the salinity of the regions water supply and would accrue these identified benefits. The reduced salinity benefits are summarized as follows:

- **Residential**
  - Increased life of plumbing system and home appliances
  - Reduced use of bottled water
  - Reduced use of water softeners
- **Commercial**
  - Decreased cost of water softening
  - Decreased cost of water (and amount of water) needed for cooling processes
  - Increased equipment life
- **Industrial**
  - Decreased cost for treatment
  - Decrease in water usage and savings in water purchase costs
  - Decrease in sewage fees from decrease in water usage and strength reduction
- **Agriculture**
  - Increase in crop yield
  - Decrease in water usage through less water needed for leaching
- **Utilities**
  - Increase in useful life of water and wastewater facilities

- **Recycled Water**
  - Lower TDS at OCSD Plant No. 1 will reduce the operating cost of GWR System/Water Factory 21/GAP

Overall the Metropolitan/USBR Salinity Management Study estimated the economic benefits of salinity reduction to be $95 million/year for every 100 mg/L reduction in salt content. Calculation of the yearly salinity benefit is problematic, as the actual salinity reduction will vary depending upon the overall basin replenishment requirement and the amount of GWR System water produced to achieve the salinity reduction.

Water Quality

The GWR System improves the basin's overall water quality by lowering total nitrogen and total organic compound (TOC) concentrations in replenishment supplies. Water quality is also improved because the project provides for better control of microbiological constituents in supply sources. In addition, as documented in the OCWD Master Plan Report (Section 7.5, page 7-25) the Orange County basin does not have the assimilative capacity for nitrate. Therefore, the District is working with the Regional Board and upstream agencies to minimize the amount of nitrates contributed to the Santa Ana River from dairy manure/wash water releases into Prado Reservoir. The District is also implementing an expanded Prado Wetlands management strategy (OCWD memo dated November 10, 1999) to construct additional wetlands to accommodate 100 percent of the base flows of the Santa Ana River through managed wetlands.

It is the authors understanding that the Santa Ana River TIN/TDS study may make recommendations to the Santa Ana Regional Water Quality Control Board regarding reduced Basin Plan amendments. Potentially, the Anaheim Forebay objectives for TDS may be reduced to 500 mg/L from the current Basin Plan objective of 600 mg/L and nitrates to 3 mg/L, the current Basin Plan for nitrates is 10 mg/L (currently the Santa Ana River flow quality is 600 mg/L TDS and the nitrates average 7-8 mg/L, as N). Should these revised standards be adopted the GWR System will enable OCWD to meet the new objectives in a manner that would assure the attainment of the Basin Plan objectives.

Placing high quality water into the Orange County Basin will have the ultimate effect of improving the basin water quality and avoiding future treatment of degraded groundwater. Current groundwater treatment costs for removal of nitrates, volatile organic compounds (voc's) and salinity ranges between $400 to $700/AF.

The key issue with respect to the GWR System is the projected improvement in nitrate quality in the Anaheim Forebay. This water quality improvement will prevent OCWD and the pumpers from having to develop well head treatment for nitrate in the future to meet potentially more stringent regulations. To calculate a dollar value associated with avoided nitrate treatment it is assumed 50% of the production in the Anaheim Forebay (or about 25,000 AFY) would require treatment to remove nitrates. Assuming the low end of the cost range delineated above, the incremental cost impact on GWR System' member agencies would be approximately $10 million per year.

Reliability/Drought Proof

The GWR System water supply can be consistently produced in both wet and dry years. Management of the Orange County groundwater basin could take into consideration the GWR System supplies and allow for overpumping in dry years thereby avoiding drought penalties or water bank purchases. In the early 1990's Metropolitan imposed $394/AF in drought penalties under the Incremental Interruption and Conservation Plan (IICP) and it cost $150 per AF to purchase water from the Governors water bank (see AGWA Discussion Paper on the "Drought Benefits of Southern California Ground Water Basins"). During future droughts Metropolitan's adopted Water Surplus and Drought Management Plan (or WSDM) calls for a complete interruption of replenishment supplies during a severe shortage.

Reviewing the recent cost of water transfers and the Governors Water Bank would suggest future drought water purchases could cost in the range of $175 to $250 per AF. The cost to consumers (both domestic and business) is more speculative in that in the 1991 drought there was very little direct economic impact except for water rate increases. Generally the cost of water has increased 10 to 25% during droughts depending on their severity.

It is difficult to attach an annual dollar value to having a drought proof supply in terms of avoided drought penalties. A scenario that assumed a sustained drought where OCWD would be forced to pay drought penalties to purchase replenishment water to avoid irreparable overdrafting of the basin would have to be evaluated. A more appropriate economic indicator would be to evaluate the impact of an unreliable or drought vulnerable water supply on the overall economy of Orange County.

Deferred/Avoided Facilities

Previous evaluations have documented the economic benefits of avoiding or deferring capital facilities as a result of the development of the GWR System. The identified avoided facilities and the associated capital cost are as follows:

1) ***Water Factory 21 Rehabilitation*** – Water Factory 21 is reaching the end of its facility life and is in need of rehabilitation. In addition, it has been documented that the Talbert Barrier is not completely effective and additional injection water is needed to provide the appropriate level of protection against seawater intrusion. It had been previously estimated that the cost to rehabilitate Water Factory 21 was about $97.1 million (OCWD Master Plan, April 1999). If the GWR System were not implemented the Water Factory 21 rehabilitation work would be required to fix the Talbert Barrier leaks.

2) ***CSDOC Outfall*** – The GWR System will divert about 100 mgd of flow from CSDOC ocean outfall. The CSDOC outfall is currently oversubscribe by 270 mgd during peak wet weather events. The GWR System would defer the need for a new outfall by diverting peak wet weather effluent flows to GWR System. CSDOC has estimated that this peak shaving would delay the need to construct a new ocean outfall by at least ten years and perhaps indefinitely. The cost of the outfall is estimated at $150 million. The direct economic benefit provided by the GWR System has been previously calculated to be $4 million per year assuming half of the delay is due to GWR System (5 years) and spreading the savings over 20 years at 6 percent.

3) ***Imported Water Distribution Facilities*** – The GWR System would potentially avoid the need for additional raw water imported supplies to achieve Metropolitan's 500 mg/L TDS blend target, specifically the Diemer bypass pipeline. This is a $3 million pipeline project to route SWP supplies around the Diemer Filtration Plant. This pipeline deferral could be accomplished due to the reduced salinity effects discussed earlier in this paper.

   The project also possibly avoids Metropolitan's proposed Cleveland Tunnel project (the Central Pool Augmentation project) through the implementation of an OCWD groundwater conjunctive use program. The Cleveland Tunnel project has a capital cost of $250 to $300 million. Metropolitan's recent review of its capital program from a cost containment perspective resulted in the project being deferred to post 2020. Further analysis taking into consideration the GWR System could result in the project being avoided altogether.

Power Consumption

The GWR System achieves a Southern California basin wide net energy reduction by reducing the pumping costs on the East Branch of the SWP. The estimated power requirement for GWR System is 1,700 kwhr/AF and the power requirement to import SWP over the Tehachipi's is 3,400 kwhr/AF. Implementation of GWR System would therefore result in a net reduction of approximately 1,700 kwhr/AF. While this power reduction is not a direct benefit that accrues to the GWR System itself, it is a region wide and statewide energy savings benefit accrued by Metropolitan and the SWP.

Construction Jobs and Permanent Operational Jobs

During construction approximately 150 to 300 direct construction jobs would be created. The construction jobs translate into a $3.5 to $6 million per year societal benefit to the local economy. This assumes each job is valued at $70,000 per year plus a multiplier of 3:1 for indirect jobs.

Industrial Base/Lower Cost and TDS of Water Service to Customers

The GWR System provides an indirect benefit to the industrial/manufacturing industry by creating a higher quality groundwater through reduced salinity levels. Lower salinity in the groundwater basin results in a lower TDS supply to industry. Key industrial applications where this benefit is particularly relevant include boiler feed, cooling and sanitation/irrigation. In general the impacts of salinity is minimal on industry if the TDS is kept below 500 mg/L and increases dramatically when TDS rises significantly above 500 mg/L (reference: USBR/Metropolitan Salinity Management Study, Technical Appendix on Economic Impacts of Changes in Water Supply Salinity, Section 4, Industrial Impacts)

The result of GWR System on the Orange County groundwater basin is TDS will slowly not continue to increase (over the last 20 years the TDS has increased on average 14 mg/L per year). Therefore, the benefit of lower TDS can be calculated at 350,000 AF pumped at 14 mg/L (assume no increase in the future, maintain overall salt balance) x the Salinity Management Study model economic benefit of $95 million per 100 mg/L increase or decrease would result in an estimated benefit of approximately $13 million per year to the customers overlying the Orange County basin. This economic benefit is for maintaining the salt balance at the current status quo and not increasing the salinity at the current average rate of 14 mg/L per year.

Basin Management/Conjunctive Use Opportunities

The current Basin Plan Objective for Salinity is 600 mg/L. The GWR System provides supply security to Orange County during future droughts that a firm replenishment supply of superior quality will be maintained to assure that overpumping/drafting of the basin can be maintained to provide drought supply reserves to the OCWD service area. (See attached AGWA paper).

EXTERNALITIES – "SOFT BENEFITS"

The following are "soft" or "political" benefits of the project for which it is difficult to attach a dollar figure. At this juncture it is more helpful to talk about how the GWR System benefits assist OCWD and CSDOC to accomplish its other water supply, wastewater disposal and policy objectives.

- **Statewide CALFED Bay-Delta Program Benefits** – development of new supplies in southern California reduce the need for Delta exports (via State Water Project), the incremental costs of developing new supplies on the SWP are approximately $250 - $450 per acre-foot excluding the large state and federal subsidies for ecosystem restoration (DWR Bulletin 160-98).
- **Diversify Supplies with Local More Reliable Sources** – the development of increased yield of the groundwater basins is a high priority of the Metropolitan Water District (Integrated Water Resources Plan, 1996) and increases significantly the reliability of the overall imported water supplies within the Metropolitan service area (Water Surplus and Drought Management Plan adopted by Metropolitan Board of Directors in April 1999).
- **Increases SWP reliability by Decreasing Firm Deliveries to Metropolitan** – the SWP can only reliably deliver in normal years about 2.8 million acre-feet, total contractual rights on the SWP is 4.1 million acre-feet. During a repeat of the 1987-1992 drought period the SWP deliveries average approximately 1.1 million acre-feet (ACWA press report November 1999), therefore all efforts to reduce the dry year needs from the SWP expand significantly the overall reliability of the SWP during dry and critical drought conditions.
- **Reduces Pressure on Upper vs. Lower Watershed Issues** – the base flow of the Santa Ana River is currently about 195 cfs and is expected to increase to over 300 cfs during the next thirty years. However, SAWPA through the Water Bond is planning to develop local water recycling projects and groundwater conjunctive use programs to store and reuse local water supplies in the upper Santa Ana River Watershed. Thus the GWR System avoids the competition for supplies between the upper and lower watersheds of the Santa Ana River.
- **Assists in Santa Ana Watershed ESA Issues** – the least Bells Vireo is a threatened species under the Endangered Species Act and the native fish, the Santa Ana River Sucker, is proposed to be listed by the U.S. Fish and Wildlife Service. Clearly the GWR System will allow for more flexible flow management in the Prado Dam reach to provide for expanded habitat for the native species of the Santa Ana River.
- **Annexation Issues** – to the degree that expanded yield of the Basin provides more local supply to a larger service area of the Orange County Water District then the benefits of the GWR System increase to a larger population base and increase the reliability of water supplies to a larger area of Orange County.
- **Attract/Foster "Clean Industry" – Economic Growth with Lower Cost Water** – developing direct use of recycled water provides immediate economic development benefits to local commercial and industrial firms within the GAP service area. These firms will receive water service at a lower cost than comparable potable service, 100 percent reliability (no rationing), and a significant marketing tool to attract new industry and jobs to Orange County.

CONCLUSIONS

GWR System has significant multiple benefits to OCWD and CSDOC customers. In addition, the benefits to the region and the State of California as a whole for developing new local supplies are critical to developing a statewide solution to the future allocations of Bay-Delta watershed supplies. The following matrix table summarizes the benefits of the GWR System and their associated value.

BENEFIT	BENEFIT TYPE	COMMENT	VALUE
Water Supply	Direct	GWR System avoids the purchase of approximately 66,600 AFY of replenishment water.	$24,800,000/yr
Salinity Reduction	Societal	Improved water quality results in numerous residential, commercial, industrial, agricultural, facility and recycled water benefits. The Metropolitan/USBR salinity management economic model calculates the benefit at $95 million per year for every 100 mg/L reduction in salt content.	$10 to $13 million per year
Water Quality	Direct	Increased water quality avoids wellhead treatment for nitrate removal in the Anaheim Forebay.	$10 million/yr
Reliability/Drought Proof	Direct	Avoid periodic drought penalties and water rate increases in droughts.	$175/AF to $250/AF
Deferred and Avoided Facilities	Direct	WF 21 Rehabilitation is not needed because GWR System would replace WF 21 facilities.	$97.1 million
	Direct	Expanded CSDOC outfall could be deferred 10 years because peak wet weather flows would be diverted to GWR System.	$4 million per year for 10 years
	Regional	Imported Water Distribution Facilities – Metropolitan's Diemer Bypass Pipeline project could be avoided because the 500 mg/L TDS blend target could be achieved through the GWR System. Potentially, the Central Pool Augmentation Project ($250 million) could also be avoided rather than deferred to post 2020 as is currently planned by Metropolitan.	$3 million
Power Consumption	Regional and Statewide	GWR System achieves a net power reduction of 1,300 kwhr/AF by avoiding importing SWP supplies for replenishment water.	
Jobs	Societal	The GWR System would create approximately 150 to 300 direct construction jobs and associated indirect economic benefits.	$3.5 to $6 million per year under construction
Basin Management/Conjunctive Use	Societal	GWR System provides supply security during future droughts to assure that over pumping/drafting of the basin can be maintained to provide drought supply reserves to the OCWD service area.	

CalFed	Societal	Development of new GWR System supply reduces the need for Delta exports via the State Water Project.
Reliability/Diversification	Regional	Development of increased yield of groundwater basins is a high priority of Metropolitan and significantly increases the reliability of the overall imported water supplies with the Metropolitan service area.
Increase SWP Reliability	Statewide	All local efforts, such as the GWR System, to reduce the dry year needs from the SWP expand significantly the overall reliability of the SWP during dry and critical drought conditions.
Santa Ana Watershed	Regional	The GWR System helps avoid the competition for supplies between the upper and lower watersheds of the Santa Ana River.
Endangered Species Act	Regional	GWR System will allow for more flexible flow management in the Prado Dam reach of the Santa Ana River to provide for expanded habitat of native species.
Annexation	Local	GWR System facilitate an expanded dependable yield of the Orange County groundwater basin which could provide more local supply to a greater service area of OCWD.
Attract Industry	Regional	GWR System would provide industry with high quality recycled water at a lower cost than comparable potable service and 100 percent reliability. This is a significant marketing too to attract new industry and jobs to Orange County.

California Regional Water Quality Control Board
Santa Ana Region

Order No. 01-23
NPDES No. CA0105694

Waste Discharge Requirements
for
The Metropolitan Water District of Southern California
Robert B. Diemer Filtration Plant
Yorba Linda, Orange County

The California Regional Water Quality Control Board, Santa Ana Region (hereinafter Board), finds that:

1. On August 30, 2000, the Metropolitan Water District of Southern California (hereinafter discharger) submitted a complete report of waste discharge for renewal of its permit to discharge wastes under the National Pollutant Discharge Elimination System from the Robert B. Diemer Filtration Plant. Discharges from the facility are currently regulated under Order No. 96-23, NPDES No. CA0105694, which expired on March 1, 2001.

2. The Robert B. Diemer Filtration Plant treats a blend of raw water from the California State Water Project and the Colorado River for potable use. The water treatment plant waste is discharged to six settling basins, two of which are used for emergency backup. The following is a list of outfall locations, discharge volumes, and discharge points:

Outfall No.	**Latitude**	**Longitude**	**Discharge (gpd)**	**Discharge to**
001[1]	33°54’36”	117°48’50”	100,000	Telegraph Canyon Creek and Carbon Canyon Creek
002[2]	33°54’50”	117°49’20”	-----	Unnamed water course and Carbon Canyon Creek
003[3]	33°54’49”	117°49’01”	25,000	Telegraph Canyon Creek
004[4]	33°54’51”	117°49’10”	10,000	Unnamed water course and Telegraph Canyon Creek

3. Telegraph Canyon Creek is tributary to Carbon Canyon Creek. Flows in Carbon Canyon Creek can be diverted to the Santa Ana River, Reach 2 or the San Gabriel River, depending on recharge and flood control needs.

1 Four sedimentation basins.
2 Two emergency discharge sedimentation basins.
3 Plant rejection structure (hydraulic overflow, leakage, and nuisance water discharge).
4 Leakage discharge from 25 million gallon reservoir.

4. A revised Water Quality Control Plan (Basin Plan) became effective on January 24, 1995. The plan contains beneficial uses and water quality objectives for water in the Santa Ana Region.

5. A revised Basin Plan applicable to the San Gabriel River was adopted by the Los Angeles Regional Water Quality Control Board (Region 4) and became effective February 23, 1995.

6. The requirements contained in this order are necessary to implement both Basin Plans.

7. The beneficial uses of Carbon Canyon Creek and Reach 2 of the Santa Ana River include:

   a. Municipal and domestic supply,
   b. Agricultural supply,
   c. Groundwater recharge,
   d. Water contact recreation,
   e. Non-contact water recreation,
   f. Warm freshwater habitat,
   g. Wildlife habitat, and
   h. Rare, threatened or endangered species.

8. The beneficial uses of the San Gabriel River include:

   a. Municipal and domestic supply,
   b. Water contact recreation,
   c. Non-contact water recreation,
   d. Warm freshwater habitat, and
   e. Wildlife habitat.

9. The discharges overlie the Santa Ana Forebay Groundwater Subbasin, the beneficial uses of which include:

   a. Municipal and domestic supply,
   b. Agricultural supply,
   c. Industrial service supply, and
   d. Industrial process supply.

10. In accordance with Water Code Section 13389, the issuance of waste discharge requirements for this discharge is exempt from those provisions of the California Environmental Quality Act contained in Chapter 3 (commencing with Section 21100), Division 13 of the Public Resources Code.

11. The Board has considered andtidegradation pursuant to 40 CFR 131.12 and State Board Resolution No. 68-16, and finds that this discharge is consistent with those provisions.

12. Effluent limitations and new source performance standards established pursuant to Section 301, 302, 303(d), 304, and 306 of the Clean Water Act and amendments thereto are applicable to the discharge.

13. The Regional Board has notified the discharger and other interested agencies and persons of its intent to prescribe revised waste discharge requirements for the discharge and has provided them with an opportunity to submit their written views and recommendations.

14. The Regional Board, in a public meeting, heard and considered all comments pertaining to the discharge.

IT IS HEREBY ORDERED that the discharger, in order to meet the provisions contained in Division 7 of the California Water Code and regulations adopted thereunder, and the provisions of the Clean Water Act and the regulations and guidelines adopted thereunder, shall comply with the following:

A. EFFLUENT LIMITATIONS

1. The four-month average suspended solids concentration of the discharge shall not exceed 30 milligrams per liter.

2. The 12-month average total dissolved solids (TDS) concentration shall not exceed 650 mg/l, unless the discharger implements a plan, with the approval of the Executive Officer, to offset TDS discharges in excess of 650 mg/l.

3. The 12-month average TDS concentration shall not exceed the 12-month average TDS concentration in the water supply by more than 75 mg/l, unless the discharger implements a plan, with the approval of the Executive Officer, to offset TDS discharges in excess of the 75 mg/l mineral increment

4. The discharge of any substances in concentrations toxic to human, animal, plant, or aquatic life is prohibited.

5. The pH of the discharge shall be at all times within the range of 6.5 and 8.5 pH units.

6. The discharge of wastes to property not owned or controlled by the discharger is prohibited.

7. There shall be no visible oil and grease in any discharge.

B. RECEIVING WATER LIMITATIONS

1. The discharge of wastes shall not cause a violation of any applicable water quality standards for receiving waters adopted by the Board or State Board, as required by the Clean Water Act and regulations adopted thereunder.

2. The discharge shall not cause any of the following:

   a. Coloration of the receiving waters, which causes a nuisance or adversely affect beneficial uses.

   b. Contain taste or odor producing substances at concentrations that cause a nuisance or adversely affect beneficial uses.

   c. The deposition of oil, grease, wax or other materials in concentrations which result in a visible film or in the coating of objects in the water, or which cause a nuisance or affect beneficial uses.

   d. The deposition of objectionable deposits along the banks or the bottom of the stream channel.

   e. The depletion of the dissolved oxygen concentration below 5.0 mg/l in the receiving waters. In addition, the waste discharge shall not cause the median dissolved oxygen concentration to fall below 85% of saturation or the 95th percentile concentration to fall below 75% of saturation within a 30-day period.

   f. Raise the temperature of the receiving waters above 90°F (32°C) which normally occurs during the period of June through October, or above 78°F (26°C) during the rest of the year.

   g. A change in the ambient pH levels more than 0.5 pH units.

   h. The presence of radioactive materials in concentrations which are deleterious to human, plant or animal life.

   i. The increase in the amounts of suspended or settleable solids of the receiving waters, which will cause a nuisance or adversely affect beneficial uses as a result of controllable water quality factors.

   j. The concentration of pollutants in the water column, sediments, or biota to adversely affect the beneficial uses of the receiving water. The discharge shall not result in the degradation of inland surface water communities and populations, including vertebrate, invertebrate, and plant species

k. The bioaccumulation of chemicals in aquatic resources to levels that are harmful to human health.

3. The discharger shall take all reasonable steps to minimize any adverse impact to receiving waters resulting from noncompliance with any effluent limitations specified in this Order, including such accelerated or additional monitoring necessary to determine the nature and impact of the non-complying discharge.

C. PROVISIONS

1. This order shall serve as a National Pollutant Discharge Elimination System (NPDES) permit pursuant to Section 402 of the Federal Water Pollution Control Act, or amendments thereto, which shall become effective 10 days after date of its adoption provided the Regional Administrator of the Environmental Protection Agency has no objection. If the Regional Administrator objects to its issuance, the order shall not serve as an NPDES permit until such objection is withdrawn.

2. This Order expires on June 1, 2006 and the discharger must file an application in accordance with Title 23, Division 3, Chapter 9 of the California Code of Regulations not later than 180 days in advance of such expiration date as application for issuance of new waste discharge requirements.

3. The discharger shall comply with Monitoring and Reporting Program No. 01-23. The Executive Officer of the Board may revise this monitoring and reporting program at any time to increase the number of parameters to be monitored, the frequency of monitoring or reporting, or the number and size of samples to be collected.

4. In an enforcement action, it shall not be a defense for a discharger that it would have been necessary to halt or reduce the permitted activity in order to maintain compliance with the conditions of this Order.

5. The Board, EPA, and other authorized representatives shall be allowed:

   a. Entry upon premises where a regulated facility or activity is located or conducted, or where records are kept under the conditions of this Order;

   b. Access to copy any records that are kept under the conditions of this Order;

   c. To inspect any facility, equipment (including for monitoring and control), practices, or operations regulated or required under this Order, and

   d. To photograph, sample and monitor for the purpose of compliance with this Order, or as otherwise authorized by the Clean Water Act.

6. Except for data determined to be confidential under Section 308 of the Clean Water Act, all reports prepared in accordance with terms of this Order shall be available for public inspection at the offices of the Regional Water Quality Control Board and the Regional Administrator of the EPA. As required by the Clean Water Act, effluent data shall not be considered confidential. Knowingly making false statements on any such report may result in the imposition of criminal penalties as provided for in Section 309 of the Act and Section 13387 of the California Water Code.

7. The discharger shall take all reasonable steps to minimize or prevent any discharge that has a reasonable likelihood of adversely affecting human health or the environment.

8. The discharger shall report any noncompliance that may endanger health or the environment. Any information shall be provided to the Executive Officer (909-782-4130) and the Office of Emergency Services (1-800-852-7550), if appropriate, as soon as the discharger becomes aware of the circumstances. A written report shall be submitted within five days and shall contain a description of the noncompliance and its cause; the period of noncompliance, including exact dates/times and, if the noncompliance has not been corrected, the anticipated time it is expected to continue; and steps taken or planned to reduce, eliminate, and prevent reoccurrence of the noncompliance. The Executive Officer or the Executive Officer's designee may waive the above-required written report on a case-by-case basis.

9. The discharger shall, at all times, properly operate and maintain all facilities and systems of treatment and control (and related appurtenances) which are installed or used by the discharger to achieve compliance with this Order. Proper operation and maintenance includes effective performance, adequate funding, adequate staffing and training, and adequate laboratory and process controls including appropriate quality assurance procedures.

10. The provisions of this Order are severable, and if any provision of this Order, or the application of any provisions of this Order to any circumstance, is held invalid, the application of such provision to other circumstances, and the remainder of this Order shall not be affected thereby.

11. The provisions and requirements of this Order do not authorize the commission of any act causing injury to the property of another, nor protect the discharger from liabilities under federal, state, or local laws, nor guarantee the discharger a capacity right in the receiving waters.

12. This Order does not convey any property rights of any sort, or any exclusive privilege.

13. The discharger shall file with the Board a report of waste discharge at least 120 days before making any material change or proposed change in the character, location, or volume of the discharge. The discharger shall give advance notice to the Board of any planned changes in the permitted facility or activity that may result in noncompliance with these waste discharge requirements.

14. In the event of any change in control of the waste discharge facility presently controlled by the discharger, the discharger shall notify the succeeding owner or operator of the existence of this Order by letter, a copy of which shall be forwarded to the Board.

15. This Order is not transferable to any person except after notice to and approval by the Board. The Board may require modification, or revocation and re-issuance, of this Order to change the name of the discharger and incorporate such other requirements as may be necessary under the Clean Water Act.

16. Order No. 96-23 is hereby rescinded.

17. The discharger shall maintain a copy of this Order at the site so that it is available to site operating personnel at all times. Key operating personnel shall be familiar with its content.

D. PERMIT REPOPENING, REVISION, REVOCATION, AND RESISSUANCE

1. This Order may be reopened to address any changes in state, federal plans, policies or regulations which would affect the quality requirements for the discharges.

2. This Order may be modified, revoked and reissued, or terminated for cause. No permit condition will be stayed by the filing of a request by the discharger for modification, revocation and re-issuance, or termination of this Order, or by a notification of anticipated noncompliance or planned changes.

3. This Order may be reopened to include effluent limitations for pollutants determined to be present in significant amounts in the discharge through any monitoring program.

I, Gerard J. Thibeault, Executive Officer, do hereby certify that the foregoing is a full, true, and correct copy of an order adopted by the California Regional Water Quality Control Board, Santa Ana Region, on June 1, 2001.

Gerard J. Thibeault
Executive Officer

California Regional Water Quality Control Board
Santa Ana Region

Monitoring and Reporting Program No. 01-23

NPDES No. CA0105694
for
Metropolitan Water District of Southern California
Robert B. Diemer Filtration Plant
Yorba Linda, Orange County

A. MONITORING AND REPORTING REQUIREMENTS

1. All sampling and sample preservation shall be in accordance with the current edition of *"Standard Methods for the Examination of Water and Wastewater"* (American Public Health Association).

2. All laboratory analyses shall be performed in accordance with test procedures under 40 CFR Part 136 (latest edition) *"Guidelines Establishing Test Procedures for the Analysis of* promulgated by the United States Environmental Protection Agency (EPA), unless otherwise specified in this monitoring and reporting program (M&RP). In addition, the Regional Board and/or EPA, at their discretion, may specify test methods that are more sensitive than those specified in 40 CFR 136.

3. Chemical, bacteriological, and bioassay analyses shall be conducted at a laboratory certified for such analyses by the State Department of Health Services or EPA or at laboratories approved by the Regional Board's Executive Officer.

4. Whenever the discharger monitors any pollutant more frequently than is required by this order, the results of this monitoring shall be included in the calculation and reporting of the data submitted in the discharge monitoring report specified by the Executive Officer.

5. All analyses shall be conducted at a laboratory certified for such analyses by the State Department of Health Services or EPA or at laboratories approved by the Executive Officer of the Regional Board.

6. Discharge monitoring data shall be submitted in a format acceptable by the Regional Board. Specific reporting format may include preprinted forms and/or electronic media. The results of all monitoring required by this Order shall be reported to the Regional Board, and shall be submitted in such a format as to allow direct comparison with the limitations and requirements of this Order. The hard copy of submitted reports shall serve as the official submittal.

7. The discharger shall tabulate the monitoring data to clearly illustrate compliance and/or noncompliance with the requirements of the Order.

8. For every item of monitoring data where the requirements are not met, the monitoring report shall include a statement discussing the reasons of noncompliance, and of the actions undertaken or proposed which will bring the discharge into full compliance with requirements at the earliest time, and an estimate of the date when the discharger will be in compliance. The discharger shall notify the Regional Board by letter when compliance with the time schedule has been achieved.

9. The discharger shall assure that records of all monitoring information are maintained and accessible for a period of at least five years from the date of the sample, report, or application. This period of retention shall be extended during the course of any unresolved litigation regarding this discharge or by the request of the Board at any time. Records of monitoring information shall include:

   a. The dates, exact place, and time of sampling or measurements;
   b. The individual(s) who performed the sampling, and/or measurements;
   c. The date(s) analyses were performed;
   d. The laboratory which performed the analyses;
   d. The individual(s) who performed the analyses;
   e. The analytical techniques or methods used;
   f. All sampling and analytical results;
   g. All monitoring equipment calibration and maintenance records;
   h. All original strip charts from continuous monitoring devices;
   i. All data used to complete the application for this Order; and,
   j. Copies of all reports required by this Order.

10. The flow measurement system shall be calibrated at least once per year or more frequently, to ensure continued accuracy.

B. EFFLUENT MONITORING

1. A sampling station shall be located where representative samples of the discharge can be obtained from Outfall 001, the four sedimentation basins and Outfall 003, the plant rejection structure (hydraulic overflow, leakage, and nuisance water discharge). The following shall constitute the effluent monitoring program:

Constituent	Units	Type of Sample	Minimum Frequency of Sample
Flow	MGD	Flow Meter	Continuous
pH	pH units	Grab	Monthly
Lead	mg/l	Grab	Monthly
Selenium	mg/l	Grab	Monthly
Suspended Solids	mg/l	Grab	Monthly
Total Chlorine Residual	mg/l	Grab	Monthly
Total Dissolved Solids	mg/l	Grab	Monthly

Constituent	Units	Type of Sample	Minimum Frequency of Sample
Toxicity Testing	See Section C, below	Grab	Quarterly
EPA Priority Pollutants (See Attached List)	µg/l	Grab	Quarterly

2. Monthly samples shall be collected by the 10th working day of each month.

3. Quarterly samples shall be collected by the 10th working day of January, April, July, and October.

4. The total amount of salt (TDS) discharged from the facility to the Santa Ana River, Carbon Canyon Creek, and Telegraph Canyon Creek, the excess amount of salt requiring offset, and the mitigation methods taken shall be determined and reported annually.

5. The monitoring frequency for those priority pollutants that are detected during the required quarterly monitoring shall be accelerated to monthly. To return to the monitoring frequency specified, the discharger shall request and receive approval from the Regional Board's Executive Officer or designee.

C. TOXICITY MONITORING

1. The discharger shall conduct critical life stage chronic toxicity testing in accordance with Method 1002.0 – Survival and Reproduction test for the water flea, *Ceriodaphnia dubia* as specified in "*Short Term Methods for Estimating the Chronic Toxicity of Effluents and Receiving Waters to Freshwater Organisms,*" third edition, Environmental Monitoring Systems Laboratory, U.S. Environmental Protection Agency 1994, Cincinnati, Ohio (July 1994, EPA/600/4-91/002).

2. The presence of chronic toxicity shall be estimated as specified in Short Term Methods for Estimating the Chronic Toxicity of Effluents and Receiving Waters to Freshwater Organisms, Third Edition, EPA/600/4-91/002.

3. Results shall be reported in TUc, where Tuc = 100/NOEC or 100/Icp or ECp (in percent effluent). The no observed concentration (NOEC) is the highest concentration of toxicant to which organisms are exposed in a chronic test, that causes no observable adverse effect on the tests organisms (e.g., the highest concentration of toxicant to which the values for the observed responses are not statistically significant different from the controls). The inhibition concentration (IC) is a point estimate of the toxicant concentration that causes a given percent reduction in a non-quantal biological measurement (e.g., reproduction or growth) calculated from a continuous model (the EPA Interpolatiom Method). The effective concentration (EC) is a point estimate of the toxicant concentration that would cause a given percent reduction in quantal biological measurement (e.g., larval development, survival) calculated from a continuous model (e.g., probit).

Additional Testing Requirements

a. A series of at least five dilutions and a control will be tested. The series shall be within 60% to 100% effluent concentration.

b. If organisms are not cultured in-house, concurrent testing with reference toxicants shall be conducted. Where organisms are cultured in-house, monthly reference toxicant testing is sufficient. Reference toxicants shall also be conducted using the same test conditions as the effluent toxicity test (e.g., same test duration, etc).

c. If either of the reference toxicant test or the effluent tests do no meet all test acceptability criteria as specified in the manual, then the discharger must re-sample and re-test within 14 days or as soon as the discharger receives notification of failed tests.

d. Control and dilution water should be receiving water or lab water, as appropriate, as described in the manual. If the dilution water used is different from the culture water, a second control, using culture water shall also be used.

D. REPORTING

1. Monitoring reports shall be submitted by the 30th day of the month following sampling.

2. All data developed under Effluent Monitoring B.1. above, shall be included in the annual report required in Reporting D.3, below.

3. Annually, a report shall be submitted summarizing the data collected for the TDS offset program showing compliance with the Basin Plan objectives. The report shall be submitted by January 30th of the following year.

4. For every item where the requirements are not met, the discharger shall submit a statement of the actions undertaken which will bring the discharge into full compliance with these requirements at the earliest time and submit a timetable for corrections.

5. All reports shall be signed by an authorized agent of the discharger and shall be submitted under penalty of perjury.

Ordered by ______________________________
Gerard J. Thibeault
Executive Officer

June 1, 2001

Attachment "A"

M&RP No. 01-23, NPDES No. CA0105694

Metropolitan Water District of Southern California, Robert B. Diemer Filtration Plant

EPA PRIORITY POLLUTANT LIST

Metals	Method
Antimony	ICP
Arsenic	GF/AA
Beryllium	ICP
Cadmium	ICP
Chromium	ICP
Copper	GF/AA
Lead	GF/AA
Mercury	CV/AA
Nickel	ICP
Selenium	GF/HYDRIDE
Silver	ICP
Thallium	ICP
Zinc	ICP

Miscellaneous	Method
Cyanide	335.2/335.3
Asbestos (not required unless requested)	
2,3,7,8-Tetrachlorodibenzo-P-Dioxin (TCDD)	8280

Pesticides	Method
Aldrin	608
Chlordane	"
Dieldrin	"
4, 4' - DDT	"
4, 4' - DDE	"
4, 4' - DDD	"
Alpha Endosulfan	"
Beta Endosulfan	"
Endosulfan Sulfate	"
Endrin	"
Endrin Aldehyde	"
Heptachlor	"
Heptachlor Epoxide	"
Alpha BHC	"
Beta BHC	"
Delta BHC	"
Gamma BHC	"
Toxaphene	"
PCB 1016	"
PCB 1221	"
PCB 1232	"
PCB 1242	"
PCB 1248	"
PCB 1254	"
PCB 1260	"

Base/Neutral Extractibles	Method
Acenaphthene	625
Acenaphthylene	"
Anthracene	"
Benzidine	"
Benzo (a) Anthracene	"
Benzo (a) Pyrene	"
Benzo (b) Fluoranthene	"
Benzo (g,h,i) Perylene	"
Benzo (k) Fluoranthene	"
Bis (2-Chloroethoxy) Methane	"
Bis (2-Chloroethyl) Ether	"
Bis (2-Chloroisopropyl) Ether	"
Bis (2-Ethylhexyl) Phthalate	"
4-Bromophenyl Phenyl Ether	"
Butyl Benzyl Phthalate	"
2-Chloronaphthalene	"
Chrysene	"
Dibenzo (a,h) Anthracene	"
4-Chlorophenyl Phenyl Ether	"
1,2-Dichlorobenzene	"
1,3-Dichlorobenzene	"
1,4-Dichlorobenzene	"
3,3-Dichlorobenzidine	"
Diethyl Phthalate	"
Dimethyl Phthalate	"
Di-N-Butyl Phthalate	"
2,4-Dinitrotoluene	"
2-6-Dinitrotoluene	"
1,2-Dipenylhydrazine (as Azobenzene)	"
Di-N-Octyl Phthalate	"
Fluoranthene	"
Fluorene	"
Hexachlorobenzene	"
Hexachlorobutadiene	"
Hexachlorocyclopentadiene	"
Hexachloroethane	"
Indeno (1,2,3-cd) Pyrene	"
Isophorone	"
Naphthalene	"
Nitrobenzene	"
N-Nitrosodimethylamine	"
N-Nitrosodi-N-Propylamine	"
N-Nitrosodiphenylamine	"
Phenanthrene	"
Pyrene	"
1,2,4-Trichlorobenzene	"

Acid Extractibles	Method
2-Chlorophenol	625
2,4-Dichlorophenol	"
2,4-Dimethylphenol	"
4,6-Dinitro-O-Cresol	"
2,4-Dinitrophenol	"
2-Nitrophenol	"
4-Nitrophenol	"
P-Chloro-M-Cresol	"
Pentachlorophenol	"
Phenol	"
2, 4, 6 - Trichlorophenol	"

Volatile Organics	Method
Acrolein	603
Acrylonitrile	"
Benzene	601/602
Bromoform	"
Carbon Tetrachloride	"
Chlorobenzene	"
Chlorodibromomethane	"
Chloroethane	"
2-Chloroethyl Vinyl Ether	"
Chloroform	"
Dichlorobromomethane	"
1,1-Dichloroethane	"
1,2-Dichloroethane	"
1,1-Dichloroethylene	"
1,2-Dichloropropane	"
1,3-Dichloropropylene	"
Ethylbenzene	"
Methyl Bromide	"
Methyl Chloride	"
Methylene Chloride	"
1,1,2,2-Tetrachloroethane	"
Tetrachloroethylene	"
Toluene	"
1,2-Trans-Dichloroethylene	"
1,1,1-Trichloroethane	"
1,1,2-Trichloroethane	"
Trichloroethylene	"
Vinyl Chloride	"

California Regional Water Quality Control Board
Santa Ana Region

June 1, 2001

ITEM: 7

SUBJECT: Waste Discharge Requirements, Metropolitan Water District of Southern California, Robert B. Diemer Plant, Yorba Linda, Orange County, Order No. 01-23, NPDES No. CA0105694,

DISCUSSION:

The Metropolitan Water District of Southern California owns and operates the Robert B. Diemer Filtration Plant located in the Yorba Linda area of Orange County. The facility imports and treats approximately 400 million gallons per day of raw water from the California State Water Project and Colorado River for potable use in Southern California. Approximately 100,000 gallons per day of water treatment wastewater is discharged to six settling basins, two of which are used on an emergency basis. The clarified wastewater is discharged from these basins into local drainages (Telegraph Canyon Creek, Carbon Canyon Creek, and unnamed tributaries) which are tributaries to the Santa Ana River, Reach 2, and which overlie the Santa Ana Forebay Groundwater Subbasin. At times, flows in Carbon Canyon Creek can be diverted to a tributary of the San Gabriel River.

The discharge is currently regulated under Order No. 96-23, NPDES No. CA0105694. Order No. 96-23 expired on March 1, 2001. On August 30, 2000, the discharger submitted a complete report of waste discharge for renewal of its permit.

The beneficial uses of the Santa Ana Forebay Groundwater Subbasin include municipal and domestic supply, agricultural supply, industrial services supply, and industrial process supply.

The beneficial uses of Carbon Canyon Creek include municipal and domestic supply, groundwater recharge, water contact recreation, non-contact water recreation, warm freshwater habitat, wildlife habitat, and support of rare, threatened or endangered species.

The beneficial uses of the Santa Ana River, Reach 2 include agricultural supply, groundwater recharge, water contact recreation, non-contact water recreation, warm freshwater habitat, wildlife habitat, and support of rare, threatened or endangered species.

The proposed Order limits the concentrations of suspended solids and total dissolved solids in the discharge. The suspended solids limit is based on best professional judgement to protect the beneficial uses of the receiving surface waters. The limits for total dissolved solids (TDS) are based on the water quality objective for Reach 2 of the Santa Ana River or on the quality of the water supplied to the facility plus a reasonable TDS increment. The more restrictive of the two applies to the discharge.

The Diemer plant receives water from the State Water Project and the Colorado River. Due to restricted supplies from the State Water Project, most of the water treated at Diemer comes from the Colorado River. The Colorado River water is high in TDS (640 mg/l). Because of this, the discharger has experienced difficulty in meeting the TDS limits in the permit since 1991. The discharger has implemented various projects to offset the effects of these high TDS discharges. The proposed order requires such projects to continue to be implemented in lieu of strict compliance with the TDS limits.

RECOMMENDATION:

Adopt Order No. 01-23, NPDES No. CA0105694 as presented.

Comments were solicited from the following agencies:

U.S. Environmental Protection Agency, Permits Issuance Section – Terry Oda (WTR-5)
U.S. Army District, Los Angeles, Corps of Engineers – Regulatory Branch
U.S. Fish and Wildlife Service – Carlsbad
State Water Resources Control Board, Office of the Chief Counsel – Ted Cobb
State Water Resources Control Board, Division of Water Quality – Jim Kassel
California Regional Water Quality Control Board – Los Angeles Region
State Department of Water Resources - Glendale
State Department of Fish and Game – Long Beach
State Department of Health Services – Santa Ana
Orange County Health Care Agency – Jack Miller
Orange County Public Facilities and Resources Department
Orange County Water District – Nira Yamachika
City of Yorba Linda – City Manager

Orange County Water District

Initial Expansion
of the
Groundwater Replenishment System

Engineer's Report

Mehul Patel, P.E.
August 2010

Table of Contents

List of Figures

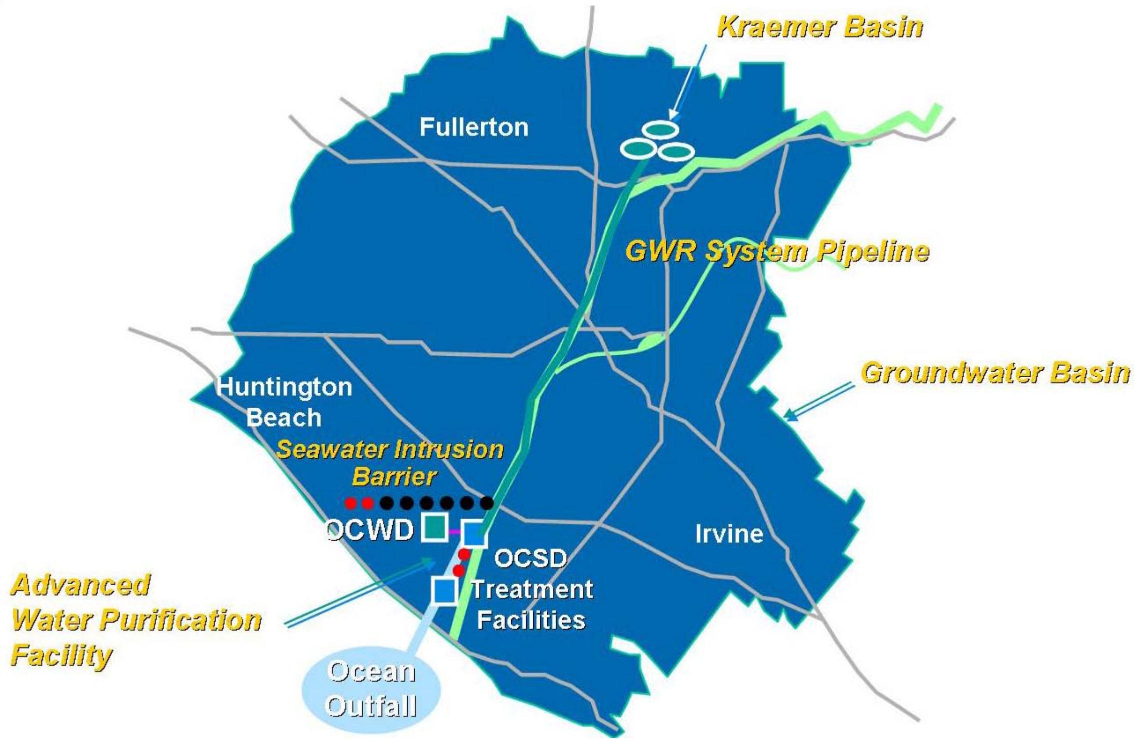
List of Tables

Introduction

The Groundwater Replenishment System (GWRS) is a water supply project constructed by the Orange County Water District (OCWD) and Orange County Sanitation District (OCSD). The GWR System supplements existing water supplies by providing reliable, high-quality source of water to recharge the Orange County Groundwater Basin (the Basin) and protect the Basin from further degradation due to seawater intrusion. By recycling water, it also provides peak wastewater flow disposal relief and indefinitely postponed the need for OCSD to construct a new ocean outfall by diverting treated wastewater flows that would otherwise be discharged to the Pacific Ocean.

Located in central Orange County, the project extends from Huntington Beach, Fountain Valley, and Costa Mesa near the coast to Santa Ana, Orange, and Anaheim generally along the Santa Ana River. The GWRS consists of three major components: (1) Advanced Water Purification Facility (AWPF) and pumping stations; (2) a major pipeline connecting the treatment facilities to existing recharge basins; and (3) expansion of an existing seawater intrusion barrier. The locations of the project components are shown on Figure 1.

FIGURE 1 – GWR SYSTEM MAP



The GWRS AWPF has been operating successfully since January 2008. Since that time, the AWPF has been operating successfully with a current production average of approximately 60 million gallons per day (mgd). The current production of 60 mgd is made possible with the operation of the OCSD Steve Anderson Lift Station (SALS). This pump station diverts additional flows to OCSD Reclamation Plant 1 which are treated by the GWRS. Because the current plant production is limited by OCSD diurnal flow fluctuations, production had been limited to approximately 24 mgd between the hours of 2 a.m. and 9 a.m. and up to 70 mgd between the hours of 9 a.m. to 2 a.m., which averages approximately 50 mgd. While it was never anticipated to operate at fluctuating flow rates throughout the day, the OCWD Water Production staff has proven that they can take advantage of higher flows in the day and increase total daily production.

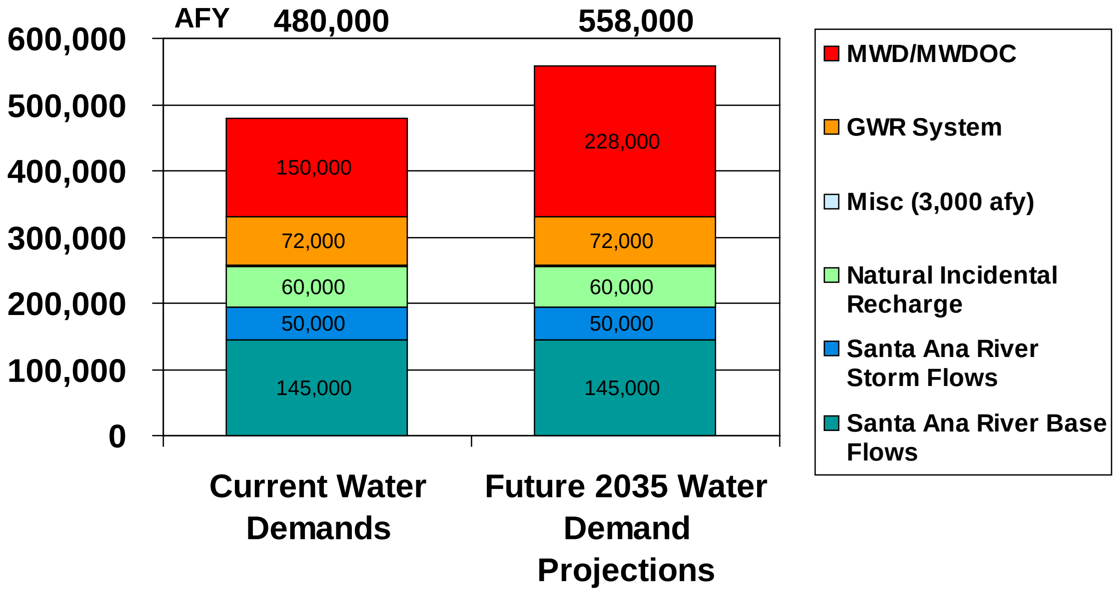
OCSD has indicated that the SALS could be operated 24 hours a day increasing both nighttime and daytime flows available for the GWRS. Knowing the AWPF can operate at various flows, the expansion of the GWRS can include greater capacity to accommodate the higher flows available during the day. In addition, OCSD is currently constructing an expansion to their secondary treatment processes which is expected to be completed in late 2011 and will provide an increased flow of secondary treated water. This Engineer's Report evaluates a 30 mgd expansion which could result in approximately 31,000 additional acre-feet per year (afy) of production from the GWRS. This expansion is a viable option based on the current success of the GWRS and the availability of other recharge sources for OCWD. It would bring the total production of the GWR System up to 103,000 afy which is equivalent to a production flow rate of 100 mgd and a 92 percent on line factor.

The expansion would entail construction of additional treatment and secondary effluent storage facilities at the AWPF site in Fountain Valley. Additional microfiltration, reverse osmosis, ultraviolet light treatment equipment, and storage tanks would be purchased and installed. In addition, pumps, electrical gear, and additional post treatment equipment will be required. A significant portion of the infrastructure has already been constructed to accommodate an expansion. This includes the yard piping, pump stations, and the electrical backbone.

Water Supply Summary

OCWD recently updated a *Long-Term Facilities Plan* (LTFP) in which water supply issues and trends were presented. Total water demands are projected to increase from approximately 480,000 afy to 558,000 afy in 2035 as shown in Figure 2. The demands are divided up based on the various water supply sources available within the OCWD service area. Water needs within OCWD boundaries are met primarily with a combination of groundwater, imported water, and recycled water. Groundwater pumping or production from the basin has been the major source of supply for areas within the basin. In order to sustain production from the basin, without overdrafting the basin and cause adverse impacts, such as increased seawater intrusion or subsidence, water must be recharged back into the basin.

FIGURE 2 – CURRENT AND FUTURE DEMANDS WITHIN THE OCWD SERVICE AREA



The supply sources listed in Figure 2 include Santa Ana River baseflow, Santa Ana River stormflow, imported supplies, natural incidental recharge, GWRS, and a small amount of miscellaneous supplies. Santa Ana River baseflow is primarily comprised of tertiary-treated wastewater discharges from wastewater treatment facilities upstream of Prado Dam. Santa Ana River baseflows are expected to remain about the same in the future. Baseflows could increase in the future due to potential growth in the Santa Ana River watershed. However this is expected to be offset by agencies reusing this source of water as imported supplies become less available and more expensive. The amount of stormflow available for recharge varies significantly from year to year due to the amount of precipitation in the watershed. As Figure 2 indicates, expected increasing water demands will force the OCWD service territory to become more dependent upon imported water supplies which may or may not be available in the future.

Imported supplies are purchased from Metropolitan Water District of Southern California (MWD) and MWDOC. MWD supplies primarily come from the Colorado River and the State Water Project. An almost decade long drought in the Colorado River watershed, along with increases in water demands in the Southwest, has reduced these supplies. Reduced snowpack and precipitation within the state have reduced State Water Project supplies. In addition, environmental restrictions on pumping from the California Bay-Delta system have significantly reduced these supplies. Significant factors which will affect the current OCWD water supply situation include:

- Below normal precipitation in the Santa Ana River Watershed for the last three years;

- The lack of MWD supplemental replenishment water since April 2007;
- MWD may allocate imported water supplies in the next one to two years, which could further increase demands on the basin;
- The anticipated lack of supplemental replenishment water through at least 2011; and
- A potential lag of three to five years before MWD can provide reliable information regarding when supplemental replenishment water is available.

Because of these factors, annual groundwater production and the level of storage in the basin have declined since 2006. Additionally, the potential to refill the basin with supplemental imported replenishment water, as has occurred in the past, is not a reliable option. It is likely that the amount of production from the basin will need to be further reduced in response to the below normal precipitation in the Santa Ana River Watershed and the lack of supplemental replenishment water.

Alternative Sources

OCWD has been developing programs and projects that will maximize the sustainable basin yield of the groundwater basin in a cost effective manner. Sustainable basin yield refers to the annual amount of production that can be maintained on a long term basis (e.g. five to ten years, or more) without overdrafting the basin. This requires matching the production of the basin with the amount recharged on a long-term basis. These projects are summarized in the LTFP. Additional opportunities to develop new water supplies and their feasibility are described below.

Long-Term Facilities Plan

The LTFP is a strategic planning tool for the District which identifies potential projects that could increase the basin's yield and protect groundwater quality. The LTFP presents a preliminary assessment of potential projects' costs and benefits, and prioritizes potential projects for more detailed analysis based upon cost, benefit and feasibility. A wide range of potential projects were identified. The preparation of the LTFP is a planning effort to screen potential projects and identify which ones to carry forward for more detailed analysis and consideration. Many of the projects presented in the LTFP address projects that have been developed to increase storm flow capture. These projects would maximize recharge of water that is normally lost to the ocean during a storm event.

Conservation

OCWD is committed to conservation with their support for MWDOC's conservation program. MWDOC, with financial support from OCWD and its 28 other member agencies, has developed and implemented a water conservation program involving various Best Management Practices (BMP), including:

- Large landscape education
- Multi-family ultra low-flush toilets (ULFT)
- Low-flow showerheads
- Single-Family ULFT
- Residential Evapotranspiration (ET) Smart Controllers
- Residential front-loading clothes washers
- Commercial ULFT
- Home and commercial water surveys
- Distribution system leak repair

MWDOC, Anaheim, Fullerton, and Santa Ana (as the MWD Member Agency within the OCWD service area) tend to be the lead agencies for implementing the conservation programs. Significant demands have been reduced and conservation efforts must remain a high priority. Even with conservation, the OCWD service area will require a substantial amount of imported water supply each year.

Water Transfers

Another option for new water sources are water transfers which will help recharge the groundwater basin. OCWD plans to explore options to acquire available water and how to convey to the Orange County groundwater basin. As Southern California's imported water provider who manages the Colorado River Aqueduct and as the major contractor along the State Water Project, MWD is generally responsible and has experience in making larger water transfers.

There are significant institutional issues to overcome to develop successful transfer programs. OCWD cannot directly compete with MWD in the water market. OCWD will explore opportunities as well as support MWD on any water transfers that are beneficial to the OCWD service area.

Desalination

Poseidon is currently developing plans for a 50 mgd ocean water desalination plant in Huntington Beach. A desalination facility in Huntington Beach could generate a significant amount of water within Orange County. This water is a new supply with an almost unlimited source. While it is a reliable source water, there are numerous permitting and institutional challenges associated with ocean water desalination.

Estimated costs for ocean desalinated water exceed $1,200/af. These high costs are linked to the large amounts of energy required for the reverse osmosis process.

As a groundwater management agency, OCWD may not have a need for this water as desalinated ocean water is generally permitted for the potable system.

Project Description

The Initial Expansion of the GWR System would include adding treatment capacity to the AWPF in Fountain Valley. Additional microfiltration, reverse osmosis, and ultraviolet light treatment equipment would be purchased and installed. In addition flow equalization of secondary effluent would be provided by the construction of two 7.5 million gallon storage tanks. The storage tanks would allow for the excess secondary effluent available in daytime hours to be stored and then fed to the GWRS during low night time flow periods. A significant portion of the infrastructure has already been constructed to accommodate an expansion. This includes the yard piping, pump stations, and the electrical backbone. When the GWRS was designed and constructed, all piping, facilities, electrical systems, and the site were designed for an ultimate capacity of 130 mgd. Because the major processes (microfiltration, reverse osmosis, and ultraviolet light) are modular systems, expansion would be relatively simple. The shaded areas in Figure 3 below identify the areas on the GWRS that would accommodate the 30 mgd expansion.

Major work of the expansion would entail:

- Demolition of the current lab facility
- Microfiltration facility construction (up to a capacity of 42 mgd)
- Reverse osmosis facility (up to a capacity of 30 mgd)
- Ultraviolet light equipment installation (up to a capacity of 30 mgd)
- Additional post-treatment facilities
- Additional reverse osmosis transfer pumps
- Additional product water and barrier pumps
- Construction of two 7.5 million gallon capacity secondary effluent storage tanks

FIGURE 3 – SITE LAYOUT FOR INITIAL EXPANSION OF THE GWRS

Laboratory Demolition

The demolition of the current laboratory is required to provide a construction lay down area for the contractor as well as for future parking for district vehicles and equipment. The demolition was also a requirement of the City of Fountain Valley permit for the new Water Quality Assurance Laboratory being constructed on the north portion of the Fountain Valley Site. This component would be sequenced first in the construction contract to accommodate a construction laydown area.

Microfiltration

The microfiltration treatment capacity would need to be expanded by approximately 42 mgd. The same type of submersible microfiltration system would be employed to maintain consistency. During the design process, a new membrane material may be evaluated and incorporated into the design. This would involve increase the existing capacity as well as constructing new basins. Because they are losses throughout the membrane processes and extra capacity will supplement Green Acres Plant supplies, 42 mgd of microfiltration capacity needs to be installed to produce 30 mgd from the reverse osmosis. Currently, there are 26 microfiltration cells which produce a total of 86 mgd. In each one of these cells, 76 additional membrane modules can be added increasing the capacity of each cell to 3.7 mgd. This brings the existing plant to a capacity of approximately 96 mgd. Two empty cells, constructed in the original GWR System contract, and one additional train (consisting of eight cells) would be installed to bring the plant capacity up to 128 mgd of microfiltration capacity. In order to convey this increased flow to the reverse osmosis, additional pumps will need to be installed in the Reverse Osmosis Transfer Pump Station.

The microfiltration equipment will be pre-selected and assigned to the contractor. Price and terms will be negotiated initially and be incorporated into the design documents. This process is similar to the approach take on the original GWR System design.

Reverse Osmosis

The expansion of the reverse osmosis entails an additional 30 mgd of treatment capacity as well as construction of a new building. The current 70 mgd of reverse osmosis treatment is within an enclosed building. Space is available to the west for an additional 60 mgd expansion. It is proposed that the entire building be constructed but only 30 mgd of reverse osmosis capacity be installed. Maintaining the same 5 mgd unit design would be desirable to reduce impacts on the operations staff. Additional cartridge filters and chemical feed systems upstream of the reverse osmosis would also be required.

Currently, the area serves as a parking lot for OCWD vehicles and equipment. Following construction of the reverse osmosis expansion, this parking area would be moved to the site of the old lab.

Ultraviolet light with Hydrogen Peroxide

The expansion of the advanced oxidation system involves installation of additional ultraviolet equipment. Each train is capable of treating 8.75 mgd of reverse osmosis product. Currently, there are three partial trains that can be built out to add 17.5 mgd of treatment capacity. Two additional trains would need to be installed to treat the 30 mgd of additional flow. The peroxide system would not need to be modified significantly.

Post-treatment

Post-treatment facilities include decarbonators and lime stabilization. Five decarbonators currently degasify the product water to reduce carbon dioxide and help restore pH. An analysis will need to be performed to determine how many additional decarbonators will be required to handle the increased flow. The same will need to be performed to evaluate whether an additional lime saturator will be required. The lime addition is required to stabilize the water before being recharged into the groundwater basin. Finally, additional barrier and product water pumps will be required to convey the water to the injection barrier or to the recharge basins in Anaheim.

Flow Equalization Storage Tanks

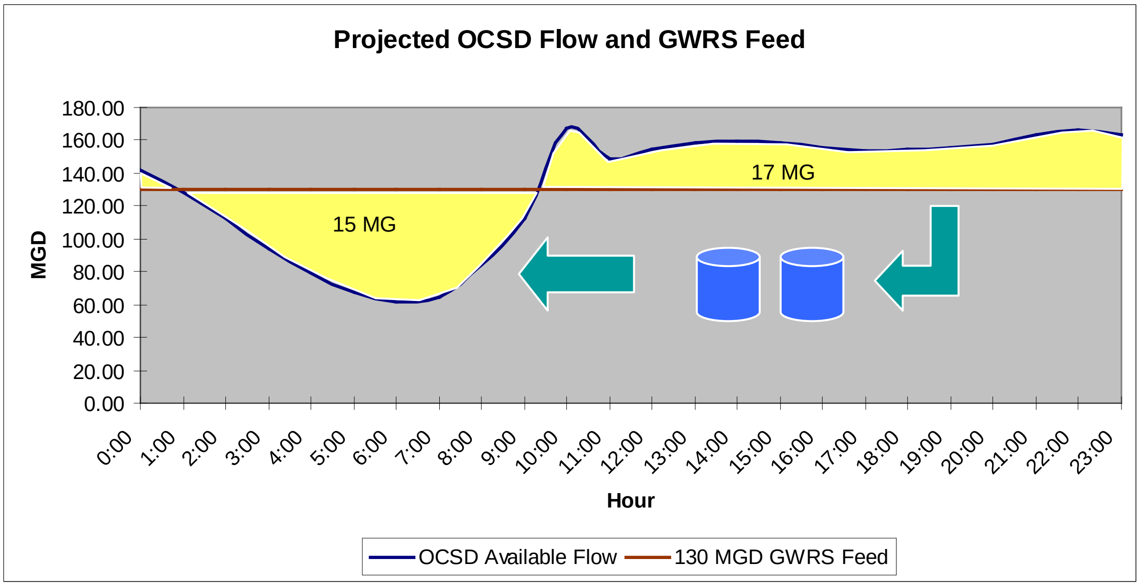
Flow equalization will be included in the GWRS Expansion Project. Flow equalization will involve the construction of two 7.5 million gallon capacity above ground steel storage tanks. The tanks would contain enough storage volume to ensure that the expansion would provide an additional 31,000 afy of production from the GWRS. The tanks will be 216 feet in diameter and 35 feet tall. The tanks will include solar powered mixers. A pump station consisting of five 75 horsepower vertical turbine pumps is included as part of the flow equalization portion of the expansion project. The pumps are used to fill the equalization tanks with excess secondary effluent. The contents are then discharged from the tanks by gravity to the GWRS screening facility. A common pipeline will be used for both filling and draining of the equalizaition tanks.

OCSD Secondary Treated Flow Availability

OCSD has provided expected flow availability information for Plant 1 when the SALS is operational. Based on these expected figures, it can be anticipated to have enough flow to produce an additional 31,000 afy from the GWRS. In order to do this, additional capacity would need to be constructed so that the GWRS AWPF could be ramped up during the day. OCSD has indicated that with the new secondary treatment available in 2012 and the 24 hour operation of the SALS, flow would be available. OCWD and OCSD have revised the existing Operations Agreement to ensure that this would be a mode of operation amenable to OCSD.

The following graph (Figure 4) identifies the current estimate of OCSD water that will be available with the SALS in operation and secondary treatment expanded in 2012. It also shows that the 15 million gallons of equalization storage make up for the short fall in available night time flows to ensure a continuous 100 mgd flow rate from the GWRS.

FIGURE 4 – EXPECTED AVAILABLE FLOW FROM OCSD PLANT 1 AFTER 2012



Based on the available flow and an annual production of 131,000 afy can be achieved. Water Production staff at OCWD has proven that they can operate the GWRS AWPF to match the diurnal curve of flow availability from OCSD. There is a difference in the flow available from OCSD and amount GWRS can produce due to the losses across the membrane processes. The GWRS needs a feed flow rate of 134 mgd in order to product 100 mgd of product water to account for losses through the membrane processes. The expansion would account for an increase of 31,000 afy to the existing GWRS.

Groundwater Recharge and Injection

As production increases out of the GWRS, it is important to consider where the water will be recharged. It is estimated that the maximum amount the Talbert Injection Barrier can inject is approximately 42 mgd depending on barrier conditions. Current GWRS flow provides sufficient water to satisfy the needs of the Talbert Injection Barrier. Excess flows from the current GWRS are recharged at Kraemer and Miller Basins in Anaheim, after the Talbert Injection Barrier needs are satisfied. The amount the injection barrier can accommodate will vary seasonally, with injection rates generally lower in the winter time when groundwater levels are higher. Table 1 lists estimates on where the GWRS water can be delivered. It is listed in two periods based on current operations and the GWRS Initial Expansion in 2012.

TABLE 1 - EXPANDED GWR SYSTEM FLOW DELIVERIES

	TOTAL (MGD)	BARRIER (MGD)	KRAEMER/MILLER (MGD)
Current	60	42	18
Beyond 2012	100	35-42	58-65

Based on average hydrology, during non-flood season Kraemer and Miller Basins will be able to handle the excess flow generated from the GWRS and its expansion. While Kraemer Basin has typically not been the primary recharge basin to be used to recharge stormflows, there will be periods that stormflows will be available to recharge. In these periods, Kraemer Basin can recharge a mixture of stormflow and GWRS water. Because there is excess capacity within Kraemer Basin even while recharging GWRS water, excess stormflows can be accommodated as well. It is currently being operated in this manner. However, if there is wetter than average year, the GWRS's production can be ramped down so that the basins can capture the additional stormflows. GWRS operational costs would be reduced for the short term as chemical and power consumption would decrease.

GWRS water has extremely low turbidity, essentially no suspended solids, and very low organic carbon concentrations. Due to the high quality, the recharge basins maintain a high percolation rates when recharged only with GWRS water. Although Kraemer and Miller Basins will often have excess capacity that could be used to recharge the GWRS Initial Expansion water, it would be advantageous to recharge the additional flows by other means. It is anticipated that GWRS water can be injected through wells or recharged through horizontal subsurface systems with minimal clogging. Santa Ana River water has a much higher sediment load compared to GWRS water and it is not practical to recharge Santa Ana River water through injection wells or subsurface recharge systems without some type of additional treatment. Surface recharge basins, like Kraemer and Miller, and the Santa Ana River channel bottom are the District's only methods for recharging Santa Ana River water. Since the GWRS water should be ideal for subsurface recharge, and surface recharge basins are the District's primary method of recharging Santa Ana River water, it would be desirable to minimize GWRS flows ultimately sent to Kraemer/Miller.

OCWD staff is currently evaluating injection near the GWRS pipeline along the Santa Ana River to recharge recycled water in the "mid-basin. Modeling has shown that recharging GWRS water through mid-basin injection wells would provide the benefit of increasing groundwater levels in a portion of the basin where groundwater levels are low during some time periods due to pumping. OCWD staff is also testing the performance of a shallow horizontal subsurface recharge system with GWRS water. This test is being conducted adjacent to Burris Basin in Anaheim.

Organizational Impact

It is anticipated that additional staff would be required to support the increased treatment capacity of the GWRS. It is currently estimated that six additional staff would be required to support the increased production. This increase includes three new operators, two maintenance technicians, and one instrumentation and electrical technician. As part of the design, a more detailed staffing plan would be generated to determine the actual need. It is not anticipated that this would increase the amount of samples analyzed by the Water Quality Assurance Laboratory so there is no increase in staffing required there.

Cost

A preliminary unit cost of $543/af has been estimated. This is based on numerous assumptions including:

- All costs escalated to the midpoint of construction in 2011
- Entire reverse osmosis building is constructed to accommodate additional expansions up to 130 mgd
- A contingency on capital improvement included
- Capital cost component financed at five percent over 30 years
- No grants or subsidies
- 92 percent online efficiency
- Annual four percent increase in all operating costs
- Six additional staff

A summary of the costs is provided below in Table 2.

TABLE 2 - PRELIMINARY COST ESTIMATE FOR PHASE 2 TREATMENT FACILITIES

CATEGORY	ESTIMATED COST
Plant wide Facilities	$12,273,792
Microfiltration/Pretreatment	$23,651,087
Reverse Osmosis	$33,564,002
Ultraviolet light (UV)/Post-Treatment	$15,407,817
Flow Equalization Tanks	$24,993,000
Contingency (5%)	$5,165,161
Other (tax, start up, etc)	$18,405,810
Subtotal construction cost	*$133,461,389*
Engineering, Legal, Administrative	$23,930,323
Grand Total	$157,391,712

The estimated cost for construction of the new facilities is $157,391,7120. A detailed cost break down is provided in the appendix. To calculate the unit cost of the water, it was assumed that the capital cost would be funded with a five percent loan repaid over 30 years. With these assumptions, the unit cost of the water is $543/af (assuming additional production of 31,000 afy). This estimate is based on an annual amortization cost of $9,522,199 and operation and maintenance costs of $6,603,000. The estimate does not account for any grant funding or subsidies. The calculation of the unit cost is shown in Table 3.

TABLE 3 - ESTIMATED UNIT COST OF PHASE 2 WATER

CATEGORY	COST
Total Capital Cost	$157,391,712
Amortized Capital Cost (5% loan over 30 years)	$9,522,199
Total Operations and Maintenance Cost	$6,603,000
Total Annual Cost	$16,125,199
Total Unit Cost	$543 per acre-foot

Note: does not include any grants or subsidies

Several grant and subsidy opportunities are available to reduce the local cost of the potential expansion. Upcoming grant opportunities include Proposition 84 and other grant funds available from the State of California. Additional capital and operational funding opportunities are available from the federal government and MWD. Grant funding opportunities from the state have expenditure deadlines which require the grant funds be utilized prior to specific deadlines. If the project was to receive $20 million in grants the unit cost would reduce to $501/af.

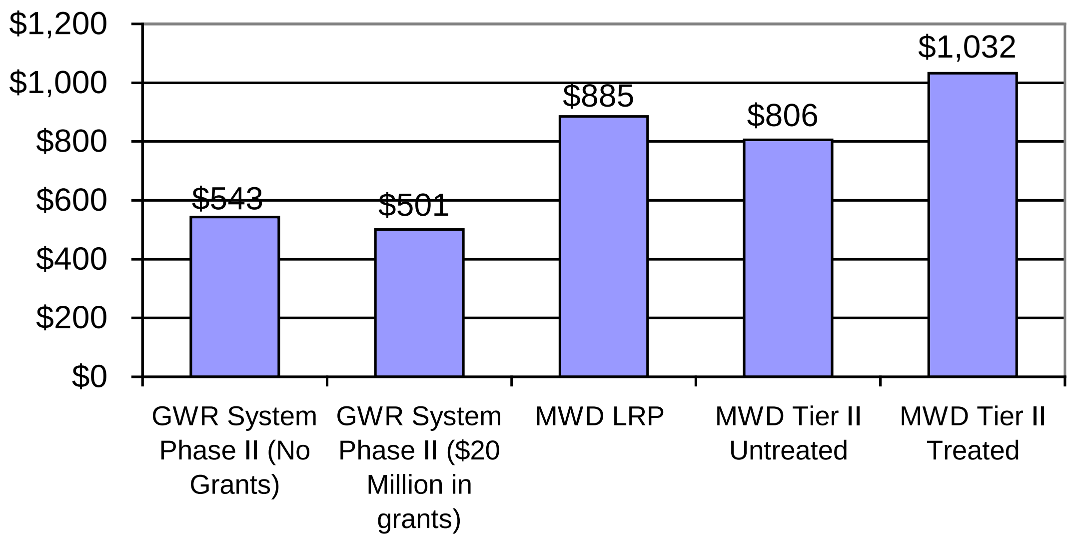
Figure 5 below displays the estimated unit costs of Phase 2 GWRS water and available MWD supplies in the year 2012. MWD rates were assumed to increase 20 percent in 2010, 12 percent in 2011, and 10 percent in 2012, as was provided in a January 13, 2009 budget and rates report to the MWD Board. The projected Tier II MWD rates include estimated equivalent $/af amounts for the MWD readiness-to-serve and capacity charges.

The MWD Local Resources Program (LRP) unit cost shown in Figure 5 is used to calculate LRP subsidy eligibility. MWD uses the difference between the two unit costs of water to calculate what the MWD LRP subsidy should be. In this case, the GWRS Initial Expansion unit cost is lower than the MWD LRP rate so no subsidy would be received. Opportunities still may exist to qualify if the unit cost of the GWRS Expansion would be higher than anticipated due to reduced production due to a wet scenario or other unknown increase. The District could enter into a MWD LRP agreement to ensure the Unit 2 water cost never exceeded the MWD LRP rate which is estimated at $885/af in 2012.

As the GWRS is creating new water supplies, it is reducing the amount of MWD Tier II treated water that must be purchased by the Producers. Currently, 10,000 to 30,000 afy of MWD Tier II water is being purchased. This amount will increase with projected increasing water demands and/or with a lower future Basin Production Percentage. Untreated Tier II MWD supplies are estimated to cost $806/af in 2012. Purchasing this water is a viable future option to assist the District in raising the Basin Production Percentage and allowing the Producers to avoid the treatment surcharge portion of the MWD rate structure. The cost of this water is estimated to be very similar to the cost of the GWRS Expansion cost assuming $20 million in grants are received for the project. Both options could be implemented in the future. The GWRS Expansion would be a higher ranked option for the following reasons:

- You are creating more reliable local water supplies;
- The water supply has a lower total dissolved solids concentration to benefit the groundwater basin;
- GWRS supplies are drought proof;
- If imported water supplies are allocated by MWD; OCWD could then be limited to only purchasing up to about 7,000 afy of this water without paying possibly much higher penalty rates.

FIGURE 5 – ESTIMATED 2012 GWR SYSTEM PHASE 2 UNIT COSTS AND MWD UNIT COSTS ($/AF)



Schedule

The schedule for next steps in implementing Initial Expansion of the GWRS, subject to Board approval, is described in Table 4 below. Throughout this process, staff will seek additional funding opportunities which include grants, operational subsidies, and loans. If at the completion of design, it is not economically beneficial to proceed, the design can be "shelved" and constructed at a later time if and when additional funds are available. The GWRS expansion would be completed after the OCSD secondary treatment expansion so that treated flow is available. This schedule matches well with OCSD's estimated completion of their secondary expansion. Currently, they are estimated to complete in late 2011.

TABLE 4 - SCHEDULE OF THE INITIAL EXPANSION OF THE GWR SYSTEM

TASK	SCHEDULE
Board Consideration to Approve Engineer's Report	February 2009
Issue Design RFP	February 2009
Award Design Contract	April 2009
Amend OCSD/OCWD Operating Agreement	May 2010
Complete Design	October 2010
Construction	January 2011 – January 2015

CEQA

The Environmental Impact Report (EIR) for the GWRS, which included Phases 1, 2, and 3, was certified in March 1999. It is anticipated that there are no additional environmental analysis required. The District would need to receive an amended permit or a new permit from the Regional Water Quality Control Board (RWQCB). The California Department of Health (DPH) is involved in this process and the conditions required by DPH are included in the permit issued by the Regional Board.

Recommendation

The Initial Expansion of the GWRS is a viable project and is feasible and necessary and of general benefit to the lands in the Orange County Water District. With droughts and environmental challenges affecting imported supplies, the new water produced through the Initial Expansion of GWRS is a cost effective water supply that exceed the water quality of any other source of water.

Appendix

Capital Cost for GWRS Expansion and Flow Equalization Project (30 mgd, 31,000 AFY)

Sub Area	Description		Amount
100	Plant Wide Facilities		$ 620,841
140	Screening Facility		$ 464,774
150	Main Laboratory		$ 585,928
160	Maintenance Building		$ 101,540
210	MF Facility		$ 20,651,252
214	MF Compressors/ Vacuum Pumps		$ 10,649
216	MF Process Air		$ 12,126
218	MF Backwash Supply Pumps		$ 48,588
220	MF CIP System		$ 4,202
230	MF BackwashWaste Pump Station		$ 126,362
235	MF Chemicals		$ 9,744
240	MF Electrical Room		$ 1,530,345
255	MF RO Transfer Pump Station		$ 1,258,539
400	Bulk Chemical Storage Facility		$ 70,058
410	Sodium Hypochlorite Bulk Storage		$ 283,543
420	Sulfuric Acid Bulk Storage		$ 272,648
430	Threshold Inhibitor Bulk Storage Area		$ 189,284
450	Cartridge Filters		$ 435,727
510	RO Building		$ 33,087,908
520	RO CIP System		$ 225,624
540	RO Electrical Building		$ 250,470
600	Site		$ 8,964
610	UV Facility		$ 9,003,153
640	UV Electrical Building		$ 63,611
710	Decarbonation		$ 1,820,709
720	MF CIP/ RO Flush Pump Station		$ 84,372
730	Lime Post Treatment Building		$ 4,234,117
750	Post Treatment Chemical Storage		$ 192,891
815	Product Water and Barrier Pump Station		$ 1,764,749
910	Switchgear Building		$ 248,137
911	GAP Facility		$ 42,563
912	Building 1		$ 130,000
999	Other (General Conditions, I&C Integration)		$ 7,064,000
	Tax at 9.25%		$ 3,812,930
	Start Up/Commissioning (1.5%)		$ 1,273,461
	Overhead & Profit (15%)		$ 7,869,944
	Escalation to Mid-Point of Construction (5.569%)		$ 5,449,475
	Subtotal		$ 103,303,228
	Design Costs		$ 6,500,000
	Design Engineer services during construction		$ 2,000,000
	Construction Management (10%)		$ 10,330,323
	Materials Testing		$ 1,600,000
	Administration (4 persons for 4 years)		$ 1,600,000

	Outreach		$ 1,200,000
	Legal Services		$ 200,000
	Outside Consultants		$ 400,000
	Surveying Services		$ 100,000
	Contingency (5%)		$ 5,165,161
	Treatment Plant Expansion Total Cost		**$ 132,398,712**
142	**Flow Equalization (Secondary Effluent Storage)**		
	Sitework		$ 1,699,000
	Equalization Tanks (2)		$ 13,625,000
	Pump Station		$ 2,547,000
	Metering Vault		$ 558,000
	Power Feed		$ 426,000
	Misc (General Requirements, Sales Tax, etc)		$ 2,400,000
	Contingency (15%)		$ 3,188,000
	Escalation to Mid-Point of Construction (3% for 0.75 years)		$ 550,000
	Flow Equalization Total Cost		**$ 24,993,000**

Total Project Capital Cost: Expansion and Flow Equalization	**$ 157,391,712**

O&M Costs		**$/Acre Foot**
Electricity		56
Chemicals		32
Labor		59
Plant Maintenance		30
R&R Fund Contribution		36
Total O&M Costs		**$ 213 per AF**

Total Project Unit Cost (Capital plus O&M) (Amortization over 30 years at 5%)	**$ 543**

Project (c) East Garden Grove Wintersburg Channel Urban Runoff Diversion

B. Water Quality and Other Benefits:

Narrative discussion of the estimates of without-project physical:

The baseline "without project" water quality conditions reflect the degraded urban runoff that is primary present in the channel which is generated from the upstream 22 square fully urbanized watershed and discharged to the Bolsa Chica, Huntington Harbor, and the coastal beaches. The downstream receiving waters have identified TMDLs and the designated uses of these water bodies are sensitive to water quality impairment, particularly with public use of the beaches involving body contact with the water and also the sensitive habitat in the wetlands. Huntington Harbor has been designated as a 303(d) impaired water body of medium priority due to urban runoff. The water quality in the flood control channel has been historically been monitored by the County of Orange Watershed Division. The water quality sampling indicated the primary load constituents included pathogens / coliform, nutrients, trash, suspended solids, and metals. The "without project" reflects the minimum water quality treatment to minimize the primary impacts to the downstream receiving waters beneficial uses. The value of the proposed project reflects treatment of the pollutants in another minimal method other than the proposed project in order to estimate a value of the water quality treatment from the project to the downstream receiving waters. Average pollutant loadings based on field water quality sampling/testing for bacteria and coliform as well as phosphorous were used to estimate the amount of chemical treatment of those pollutants.

Narrative discussion of the estimates of with-project physical condition:

The "with-project" conditions completely eliminate the pollutant load from dry-weather conditions to the downstream receiving water since it is captured the inflatable dam and diverted to the natural treatment system for reclamation. Dry-weather urban runoff pollutant loads are eliminated compared to the existing conditions because of the diversion system.

Description of methods used to estimate without- and with-project condition:

Estimating the difference between the with- and without-project conditions is based on the elimination of the pollutant load associated with the urban dry-weather flows. This pollutant load reduction can be estimated through water quality modeling using average daily pollutant concentrations measured from field sampling of the urban dry-weather flows in the channel. PREWET is a water quality model used in the engineering analysis to evaluate the effectiveness of the pollutant load reduction from the treatment system. The analysis indicated that with the 1MGD diversion that 6,000 lbs. of nitrogen, 590 lbs of Phosphorus, and 26,000 lbs of suspended solids would be removed. The details and results of the water quality modeling is provided in the Preliminary Design Report.

Description of potential other benefits:

Quantifying all the physical benefits with a monetary value from the water quality pollutant load reduction to the downstream receiving is very difficult since there are many benefits which cannot be assigned a monetary value. The pollution from the urban runoff impacts multiple downstream uses which will receive benefit from pollutant load reduction. These additional benefits include: (1) minimizing the potential of beach closure because of water quality exceedances, (2) minimizing public health issues from recreational uses in the harbor and body contact, (3) minimizing impacts to wildlife and aquatic habitat in the wetlands as well as the harbor area, (4) improved aesthetics reducing the amount of trash accumulated at the beach.

Description of the distribution of local, regional, and statewide benefits, as applicable:

The water quality benefits would be a local and regional benefit to the downstream receiving waters from the pollutant load reduction, as well as to the general public that utilizes these areas from the region.

Identification of beneficiaries:

The multiple beneficiaries of the improved water quality would include: (1) wildlife and endangered species within the Bolsa Chica coastal wetlands, (2) fisheries in the downstream receiving water aquatic habitat, (3) recreational users of the Huntington Harbor and residents, (4) general public users of the State Beach along the Bolsa Chica which is the most actively used State Park in the system.

When the benefits will be received:

Benefits would be received immediately after implementation of the diversion since it would capture and eliminate the dry-weather runoff pollutant loads from discharging downstream.

Uncertainty of Benefits:

High confidence in the proposed benefits since the stress and impacts to the downstream receiving waters in this watershed are associated with pollutants from urban runoff. The proposed diversion system completely eliminates the source of impact to the receiving waters.

Description of any adverse effects:

No adverse impact had been identified through the environmental regulatory permitting and CEQA process. The elimination of the dry-weather flows assists in re-establishing a saltwater tidal channel, without mixing in urban runoff component.

Table 16 - Water Quality and Other Expected Benefits
(All benefits should be in 2009 dollars)
Project (c) East Garden Grove Wintersburg Channel Urban Runoff Diversion (C. Huntington Beach)

(a)	(b)	(c)	(d)	(e)	(f)	(g)	(h)	(i)	(j)
Year	Type of Benefit	Measure of Benefit (Units)	Without Project	With Project	Change Resulting from Project (e) – (d)	Unit $ Value (1)	Annual $ Value (f) x (g) (1)	Discount Factor (1)	Discounted Benefits (h) x (i) (1)
2009	WQ	acre-foot			0		$0	1.000	$0
	Habitat				0		$0	1.000	$0
	Recreation				0		$0	1.000	$0
	..				0		$0	1.000	$0
2010	WQ	acre-foot			0		$0	0.943	$0
	Habitat				0		$0	0.943	$0
	Recreation				0		$0	0.943	$0
	..				0		$0	0.943	$0
2011	WQ	acre-foot	0	1330	1330	$55	$73,150	0.890	$65,104
	Habitat	acre	0	12	12	$1,600	$19,200	0.890	$17,088
	Recreation				0		$0	0.890	$0
	..				0		$0	0.890	$0
2012	WQ	acre-foot	0	1330	1330	$55	$73,150	0.840	$61,446
	Habitat	acre	0	12	12	$1,600	$19,200	0.840	$16,128
	Recreation				0		$0	0.840	$0
	..				0		$0	0.840	$0
2013	WQ	acre-foot	0	1330	1330	$55	$73,150	0.792	$57,935
	Habitat	acre	0	12	12	$1,600	$19,200	0.792	$15,206
	Recreation				0		$0	0.792	$0
	..				0		$0	0.792	$0
2014	WQ	acre-foot	0	1330	1330	$55	$73,150	0.747	$54,643
	Habitat	acre	0	12	12	$1,600	$19,200	0.747	$14,342
	Recreation				0		$0	0.747	$0
	..				0		$0	0.747	$0
2015	WQ	acre-foot	0	1330	1330	$55	$73,150	0.705	$51,571

Table 16 - Water Quality and Other Expected Benefits
(All benefits should be in 2009 dollars)
Project (c) East Garden Grove Wintersburg Channel Urban Runoff Diversion (C. Huntington Beach)

(a)	(b)	(c)	(d)	(e)	(f)	(g)	(h)	(i)	(j)
Year	Type of Benefit	Measure of Benefit (Units)	Without Project	With Project	Change Resulting from Project (e) – (d)	Unit $ Value (1)	Annual $ Value (f) x (g) (1)	Discount Factor (1)	Discounted Benefits (h) x (i) (1)
	Habitat	acre	0	12	12	$1,600	$19,200	0.705	$13,536
	Recreation				0		$0	0.705	$0
	..				0		$0	0.705	$0
2016	WQ	acre-foot	0	1330	1330	$55	$73,150	0.665	$48,645
	Habitat	acre	0	12	12	$1,600	$19,200	0.665	$12,768
	Recreation				0		$0	0.665	$0
	..				0		$0	0.665	$0
2017	WQ	acre-foot	0	1330	1330	$55	$73,150	0.627	$45,865
	Habitat	acre	0	12	12	$1,600	$19,200	0.627	$12,038
	Recreation				0		$0	0.627	$0
	..				0		$0	0.627	$0
2018	WQ	acre-foot	0	1330	1330	$55	$73,150	0.592	$43,305
	Habitat	acre	0	12	12	$1,600	$19,200	0.592	$11,366
	Recreation				0		$0	0.592	$0
	..				0		$0	0.592	$0
2019	WQ	acre-foot	0	1330	1330	$55	$73,150	0.558	$40,818
	Habitat	acre	0	12	12	$1,600	$19,200	0.558	$10,714
	Recreation				0		$0	0.558	$0
	..				0		$0	0.558	$0
2020	WQ	acre-foot	0	1330	1330	$55	$73,150	0.527	$38,550
	Habitat	acre	0	12	12	$1,600	$19,200	0.527	$10,118
	Recreation				0		$0	0.527	$0
	..				0		$0	0.527	$0
2021	WQ	acre-foot	0	1330	1330	$55	$73,150	0.497	$36,356
	Habitat	acre	0	12	12	$1,600	$19,200	0.497	$9,542

Table 16 - Water Quality and Other Expected Benefits (All benefits should be in 2009 dollars) Project (c) East Garden Grove Wintersburg Channel Urban Runoff Diversion (C. Huntington Beach)									
(a)	(b)	(c)	(d)	(e)	(f)	(g)	(h)	(i)	(j)
Year	Type of Benefit	Measure of Benefit (Units)	Without Project	With Project	Change Resulting from Project (e) – (d)	Unit $ Value (1)	Annual $ Value (f) x (g) (1)	Discount Factor (1)	Discounted Benefits (h) x (i) (1)
	Recreation				0		$0	0.497	$0
	..				0		$0	0.497	$0
2022	WQ	acre-foot	0	1330	1330	$55	$73,150	0.469	$34,307
	Habitat	acre	0	12	12	$1,600	$19,200	0.469	$9,005
	Recreation				0		$0	0.469	$0
	..				0		$0	0.469	$0
2023	WQ	acre-foot	0	1330	1330	$55	$73,150	0.442	$32,332
	Habitat	acre	0	12	12	$1,600	$19,200	0.442	$8,486
	Recreation				0		$0	0.442	$0
	..				0		$0	0.442	$0
2024	WQ	acre-foot	0	1330	1330	$55	$73,150	0.417	$30,504
	Habitat	acre	0	12	12	$1,600	$19,200	0.417	$8,006
	Recreation				0		$0	0.417	$0
	..				0		$0	0.417	$0
2025	WQ	acre-foot	0	1330	1330	$55	$73,150	0.394	$28,821
	Habitat	acre	0	12	12	$1,600	$19,200	0.394	$7,565
	Recreation				0		$0	0.394	$0
	..				0		$0	0.394	$0
2026	WQ	acre-foot	0	1330	1330	$55	$73,150	0.371	$27,139
	Habitat	acre	0	12	12	$1,600	$19,200	0.371	$7,123
	Recreation				0		$0	0.371	$0
	..				0		$0	0.371	$0
2027	WQ	acre-foot	0	1330	1330	$55	$73,150	0.350	$25,603
	Habitat	acre	0	12	12	$1,600	$19,200	0.350	$6,720
	Recreation				0		$0	0.350	$0

Table 16 - Water Quality and Other Expected Benefits
(All benefits should be in 2009 dollars)
Project (c) East Garden Grove Wintersburg Channel Urban Runoff Diversion (C. Huntington Beach)

(a)	(b)	(c)	(d)	(e)	(f)	(g)	(h)	(i)	(j)
Year	Type of Benefit	Measure of Benefit (Units)	Without Project	With Project	Change Resulting from Project (e) – (d)	Unit $ Value (1)	Annual $ Value (f) x (g) (1)	Discount Factor (1)	Discounted Benefits (h) x (i) (1)
	..				0		$0	0.350	$0
2028	WQ	acre-foot	0	1330	1330	$55	$73,150	0.331	$24,213
	Habitat	acre	0	12	12	$1,600	$19,200	0.331	$6,355
	Recreation				0		$0	0.331	$0
	..				0		$0	0.331	$0
2029	WQ	acre-foot	0	1330	1330	$55	$73,150	0.312	$22,823
	Habitat	acre	0	12	12	$1,600	$19,200	0.312	$5,990
	Recreation				0		$0	0.312	$0
	..				0		$0	0.312	$0
2030	WQ	acre-foot	0	1330	1330	$55	$73,150	0.294	$21,506
	Habitat	acre	0	12	12	$1,600	$19,200	0.294	$5,645
	Recreation				0		$0	0.294	$0
	..				0		$0	0.294	$0
2031	WQ	acre-foot	0	1330	1330	$55	$73,150	0.278	$20,336
	Habitat	acre	0	12	12	$1,600	$19,200	0.278	$5,338
	Recreation				0		$0	0.278	$0
	..				0		$0	0.278	$0
2032	WQ	acre-foot	0	1330	1330	$55	$73,150	0.262	$19,165
	Habitat	acre	0	12	12	$1,600	$19,200	0.262	$5,030
	Recreation				0		$0	0.262	$0
	..				0		$0	0.262	$0
2033	WQ	acre-foot	0	1330	1330	$55	$73,150	0.247	$18,068
	Habitat	acre	0	12	12	$1,600	$19,200	0.247	$4,742
	Recreation				0		$0	0.247	$0
	..				0		$0	0.247	$0

Table 16 - Water Quality and Other Expected Benefits
(All benefits should be in 2009 dollars)
Project (c) East Garden Grove Wintersburg Channel Urban Runoff Diversion (C. Huntington Beach)

(a)	(b)	(c)	(d)	(e)	(f)	(g)	(h)	(i)	(j)
Year	Type of Benefit	Measure of Benefit (Units)	Without Project	With Project	Change Resulting from Project (e) – (d)	Unit $ Value (1)	Annual $ Value (f) x (g) (1)	Discount Factor (1)	Discounted Benefits (h) x (i) (1)
2034	WQ	acre-foot	0	1330	1330	$55	$73,150	0.233	$17,044
	Habitat	acre	0	12	12	$1,600	$19,200	0.233	$4,474
	Recreation				0		$0	0.233	$0
	..				0		$0	0.233	$0
2035	WQ	acre-foot	0	1330	1330	$55	$73,150	0.220	$16,093
	Habitat	acre	0	12	12	$1,600	$19,200	0.220	$4,224
	Recreation				0		$0	0.220	$0
	..				0		$0	0.220	$0
2036	WQ	acre-foot	0	1330	1330	$55	$73,150	0.207	$15,142
	Habitat	acre	0	12	12	$1,600	$19,200	0.207	$3,974
	Recreation				0		$0	0.207	$0
	..				0		$0	0.207	$0
2037	WQ	acre-foot	0	1330	1330	$55	$73,150	0.196	$14,337
	Habitat	acre	0	12	12	$1,600	$19,200	0.196	$3,763
	Recreation				0		$0	0.196	$0
	..				0		$0	0.196	$0
2038	WQ	acre-foot	0	1330	1330	$55	$73,150	0.185	$13,533
	Habitat	acre	0	12	12	$1,600	$19,200	0.185	$3,552
	Recreation				0		$0	0.185	$0
	..				0		$0	0.185	$0
2039	WQ	acre-foot	0	1330	1330	$55	$73,150	0.174	$12,728
	Habitat	acre	0	12	12	$1,600	$19,200	0.174	$3,341
	Recreation				0		$0	0.174	$0
	..				0		$0	0.174	$0
2040	WQ	acre-foot	0	1330	1330	$55	$73,150	0.164	$11,997

Table 16 - Water Quality and Other Expected Benefits
(All benefits should be in 2009 dollars)
Project (c) East Garden Grove Wintersburg Channel Urban Runoff Diversion (C. Huntington Beach)

(a) Year	(b) Type of Benefit	(c) Measure of Benefit (Units)	(d) Without Project	(e) With Project	(f) Change Resulting from Project (e) – (d)	(g) Unit $ Value (1)	(h) Annual $ Value (f) x (g) (1)	(i) Discount Factor (1)	(j) Discounted Benefits (h) x (i) (1)
	Habitat	acre	0	12	12	$1,600	$19,200	0.164	$3,149
	Recreation				0		$0	0.164	$0
	..				0		$0	0.164	$0
2041	WQ	acre-foot	0	1330	1330	$55	$73,150	0.155	$11,338
	Habitat	acre	0	12	12	$1,600	$19,200	0.155	$2,976
	Recreation				0		$0	0.155	$0
	..				0		$0	0.155	$0
2042	WQ	acre-foot	0	1330	1330	$55	$73,150	0.146	$10,680
	Habitat	acre	0	12	12	$1,600	$19,200	0.146	$2,803
	Recreation				0		$0	0.146	$0
	..				0		$0	0.146	$0
2043	WQ	acre-foot	0	1330	1330	$55	$73,150	0.138	$10,095
	Habitat	acre	0	12	12	$1,600	$19,200	0.138	$2,650
	Recreation				0		$0	0.138	$0
	..				0		$0	0.138	$0
2044	WQ	acre-foot	0	1330	1330	$55	$73,150	0.130	$9,510
	Habitat	acre	0	12	12	$1,600	$19,200	0.130	$2,496
	Recreation				0		$0	0.130	$0
	..				0		$0	0.130	$0
2045	WQ	acre-foot	0	1330	1330	$55	$73,150	0.123	$8,997
	Habitat	acre	0	12	12	$1,600	$19,200	0.123	$2,362
	Recreation				0		$0	0.123	$0
	..				0		$0	0.123	$0
2046	WQ	acre-foot	0	1330	1330	$55	$73,150	0.116	$8,485
	Habitat	acre	0	12	12	$1,600	$19,200	0.116	$2,227

Table 16 - Water Quality and Other Expected Benefits
(All benefits should be in 2009 dollars)
Project (c) East Garden Grove Wintersburg Channel Urban Runoff Diversion (C. Huntington Beach)

(a)	(b)	(c)	(d)	(e)	(f)	(g)	(h)	(i)	(j)
Year	Type of Benefit	Measure of Benefit (Units)	Without Project	With Project	Change Resulting from Project (e) – (d)	Unit $ Value (1)	Annual $ Value (f) x (g) (1)	Discount Factor (1)	Discounted Benefits (h) x (i) (1)
	Recreation				0		$0	0.116	$0
	..				0		$0	0.116	$0
2047	WQ	acre-foot	0	1330	1330	$55	$73,150	0.109	$7,973
	Habitat	acre	0	12	12	$1,600	$19,200	0.109	$2,093
	Recreation				0		$0	0.109	$0
	..				0		$0	0.109	$0
2048	WQ	acre-foot	0	1330	1330	$55	$73,150	0.103	$7,534
	Habitat	acre	0	12	12	$1,600	$19,200	0.103	$1,978
	Recreation				0		$0	0.103	$0
	..				0		$0	0.103	$0
2049	WQ	acre-foot	0	1330	1330	$55	$73,150	0.097	$7,096
	Habitat	acre	0	12	12	$1,600	$19,200	0.097	$1,862
	Recreation				0		$0	0.097	$0
	..				0		$0	0.097	$0
2050	WQ	acre-foot	0	1330	1330	$55	$73,150	0.092	$6,730
	Habitat	acre	0	12	12	$1,600	$19,200	0.092	$1,766
	Recreation				0		$0	0.092	$0
	..				0		$0	0.092	$0
2051	WQ	acre-foot	0	1330	1330	$55	$73,150	0.087	$6,364
	Habitat	acre	0	12	12	$1,600	$19,200	0.087	$1,670
	Recreation				0		$0	0.087	$0
	..				0		$0	0.087	$0
2052	WQ	acre-foot	0	1330	1330	$55	$73,150	0.082	$5,998
	Habitat	acre	0	12	12	$1,600	$19,200	0.082	$1,574
	Recreation				0		$0	0.082	$0

Table 16 - Water Quality and Other Expected Benefits (All benefits should be in 2009 dollars) Project (c) East Garden Grove Wintersburg Channel Urban Runoff Diversion (C. Huntington Beach)									
(a)	(b)	(c)	(d)	(e)	(f)	(g)	(h)	(i)	(j)
Year	Type of Benefit	Measure of Benefit (Units)	Without Project	With Project	Change Resulting from Project (e) – (d)	Unit $ Value (1)	Annual $ Value (f) x (g) (1)	Discount Factor (1)	Discounted Benefits (h) x (i) (1)
	..				0		$0	0.082	$0
2053	WQ	acre-foot	0	1330	1330	$55	$73,150	0.077	$5,633
	Habitat	acre	0	12	12	$1,600	$19,200	0.077	$1,478
	Recreation				0		$0	0.077	$0
	..				0		$0	0.077	$0
2054	WQ	acre-foot	0	1330	1330	$55	$73,150	0.073	$5,340
	Habitat	acre	0	12	12	$1,600	$19,200	0.073	$1,402
	Recreation				0		$0	0.073	$0
	..				0		$0	0.073	$0
2055	WQ	acre-foot	0	1330	1330	$55	$73,150	0.069	$5,047
	Habitat	acre	0	12	12	$1,600	$19,200	0.069	$1,325
	Recreation				0		$0	0.069	$0
	..				0		$0	0.069	$0
2056	WQ	acre-foot	0	1330	1330	$55	$73,150	0.065	$4,755
	Habitat	acre	0	12	12	$1,600	$19,200	0.065	$1,248
	Recreation				0		$0	0.065	$0
	..				0		$0	0.065	$0
2057	WQ	acre-foot	0	1330	1330	$55	$73,150	0.061	$4,462
	Habitat	acre	0	12	12	$1,600	$19,200	0.061	$1,171
	Recreation				0		$0	0.061	$0
	..				0		$0		$0
2058	WQ	acre-foot	0	1330	1330	$55	$73,150	0.058	$4,243
	Habitat	acre	0	12	12	$1,600	$19,200	0.058	$1,114
	Recreation				0		$0	0.058	$0
	..								

Table 16 - Water Quality and Other Expected Benefits
(All benefits should be in 2009 dollars)
Project (c) East Garden Grove Wintersburg Channel Urban Runoff Diversion (C. Huntington Beach)

(a)	(b)	(c)	(d)	(e)	(f)	(g)	(h)	(i)	(j)
Year	Type of Benefit	Measure of Benefit (Units)	Without Project	With Project	Change Resulting from Project (e) – (d)	Unit $ Value (1)	Annual $ Value (f) x (g) (1)	Discount Factor (1)	Discounted Benefits (h) x (i) (1)
Project Life								…	**$1,363,732**
Total Present Value of Discounted Benefits Based on Unit Value (Sum of the values in Column (j) for all Benefits shown in table) Transfer to Table 20, column (f), Exhibit F: Proposal Costs and Benefits Summaries									

Comments: The details for quanitfying the numerical "value" of the benefits are provided on the next work sheet. The benefits counted are for (1) water quality treatement costs avoided for downstream receiving water uses, (2) value of creted / restored habitat

(1) Complete these columns if dollar value is being claimed for the benefit.

Project (d) Romoland Line A Flood System

B. Water Quality and Other Benefits:

Not Applicable

Project (e) Santa Ana Watershed Vireo Monitoring

B. Water Quality and Other Benefits:

SAWA's biological monitoring of endangered, native and invasive birds in the watershed directly supports SAWA's efforts to remove and maintain control over (to date) approximately 4,000 acres of land in the Santa Ana Watershed that was formerly covered in Arundo donax or Giant Reed.

During the three-year project period, SAWA intends to remove another 300 acres of Arundo at a rate of 100 acres per year. These ecosystem improvements and preservation activities will keep water-thirsty Arundo out of these areas and will allow native habitat to evolve naturally.

Healthy riparian ecosystems with native vegetation support both people and wildlife. The benefits include providing wildlife habitat and regional migration corridors, and providing recreational activities such as wildlife viewing. Although there are significant water supply savings in our restoration efforts that are quantifiable, it is difficult to quantify in monetary terms the difference these efforts have made.

Table 16 - Water Quality and Other Expected Benefits (All benefits should be in 2009 dollars) Project (e) Santa Ana Watershed Vireo Monitoring (SAWA)									
(a)	(b)	(c)	(d)	(e)	(f)	(g)	(h)	(i)	(j)
Year	Type of Benefit	Measure of Benefit (Units)	Without Project	With Project	Change Resulting from Project (e) – (d)	Unit $ Value (1)	Annual $ Value (f) x (g) (1)	Discount Factor (1)	Discounted Benefits (h) x (i) (1)
2009					0		$0	1.000	$0
2010					0		$0	0.943	$0
2011	Acres maintained Arundo-free	Acres	0	4,100	4100		$0	0.890	$0
2012	Acres maintained Arundo-free	Acres	0	4,200	4,200		$0	0.840	$0
2013	Acres maintained Arundo-free	Acres	0	4,300	4,300		$0	0.792	$0
	..				0		$0		$0
Project Life					4,300			…	
Total Present Value of Discounted Benefits Based on Unit Value (Sum of the values in Column (j) for all Benefits shown in table) Transfer to Table 20, column (f), Exhibit F: Proposal Costs and Benefits Summaries									
Comments:									

(1) Complete these columns if dollar value is being claimed for the benefit.

Project (f) Mill Creek Wetlands

B. Water Quality and Other Benefits:

Narrative discussion of the estimates of without-project physical:

The “Without Project” scenario is based on a local watershed project that would be constructed by the City of Ontario if the Cucamonga Creek Watershed Regional Water Quality Project were not proposed. Construction estimates for the Without Project physical conditions include total construction costs of \$33,562,000 and green house gas (GHG) emissions from construction of 2,800 tons of carbon dioxide (CO_2), nitrogen oxide (NO) and sulfur dioxide ($S0_2$), hereinafter referred to as CO_2-equivalent (CO_2-eq). These construction estimates are divided between two years of construction. Water quality estimates for the Without Project physical conditions include annual average treatment of 1,520 acre-feet (af) of wet-weather flows and an additional 700 af of dry-weather flows. Due to the proposed location and design of the Without Project alternative, there is a need for several pumps to lift the stormwater an average of nine feet, which is estimated to have an energy usage requirement of 55,000 kWh per year and produce estimated GHG emissions of 15 tons of CO_2-eq. Maintenance estimates for the Without Project physical conditions include two full time employees (4,160 hours) divided between several professions for a total of \$106,000. Open space benefits for the Without Project alternative include zero miles of recreational trails, and zero acres of wetland and upland habitat.

Narrative discussion of the estimates of with-project physical condition:

The “With Project” scenario is the City of Ontario’s Cucamonga Creek Watershed Regional Water Quality Project. This Project is a regional natural treatment system, ideally located for highest efficiency near the mouth of Cucamonga Creek. Construction estimates for the With Project physical conditions include total construction costs of \$21,650,000 and green house gas (GHG) emissions from construction of 2,800 tons of CO_2-eq. These construction estimates are divided between two years of construction. Water quality estimates for the With Project physical conditions include annual average treatment of 4,200 af of wet-weather flows and an additional 2,700 af of dry-weather flows. The proposed location of the With Project alternative eliminates the need for pumping so the gravity fed design has zero energy usage requirements, which in turn produces no GHG emissions. Maintenance estimates for the With Project physical conditions include one full time employee (2,080 hours) divided between several professions for a total of \$53,000. Open space benefits for the With Project alternative include 2.5 miles of recreational trails, and nine acres of wetland habitat and 23 acres of upland habitat for wildlife, including endangered species.

Description of methods used to estimate without- and with-project condition:

The methods used to estimate benefits for the Without Project and With Project Alternatives are summarized below and are included in the comments section at the bottom of Table 16. Construction costs for both project alternatives were estimated based on equivalent levels of treatment and design volumes of treatment. The Project costs address around 44 acres, the Non-Project costs address an "equivalent" 40 acres. The basis for this assumption is the efficiency reached in the Project scenario and the inefficiency of the Non-Project scenario with three separate sub projects to the single Project for the Mill Creek Wetlands. This is coupled with the sharing of the Project with the City of Chino (approximately 17%). That loss of capacity to Ontario coupled with the inefficiency of having several separate basins on site serves as the basis for estimating equivalency. The remainder costs are fairly consistent between both scenarios with earthwork, structures, landscaping and access roads necessary. Maintenance costs assumed prevailing wages from the California Department of Industrial Relations. Construction GHG emissions were calculated in Investigative Science and Engineering's 2008 report titled Greenhouse Gas / Global Warming Risk Assessment, Mill Creek Wetlands Recreation and Restoration Demonstration Project, San Bernardino County CA. Wet and dry-weather water quality benefit calculations for both project alternatives were based on Geosyntec's 2009 report, titled Public Benefits to Water Quality - Cucamonga Creek Watershed Water Quality Project. They were also based on a fraction of the estimated cost per acre-foot as calculated in the December 2009 Ballona Creek TMDL Implementation Plans developed by the City of Los Angeles, designed to address both Metals and Bacteria impairments. This fraction was assumed to be 50%, based on the fact that the With Project Alternative has many siting and implementation advantages and is not sited in a highly urbanized environment as are the projects in the Ballona Creek TMDL Implementation Plans. As such the constraints and costs will be lower (assumed to be one-half) per acre-foot treated. Energy consumption for the Without Project Alternative was calculated based 2.75 kWh/AF/foot of lift (LADWP Communication, 2010). Energy consumption for the With Project Alternative is zero. GHG emissions calculations were based on energy consumption multiplied by 0.542 pounds of CO_2-eq from EPA's eGrid, 2005. Maintenance effort for the Without Project was estimated as two full time employees based on distributed site design and mechanical techniques and is broken down between 3,000 hours Landscape Maintenance Worker at $11/hr, 1,000 hours of Professional Worker at $65/hr, and 160 hours of Landscape Operator at $47/hr. Maintenance effort estimates for the With Project Alternative is one full time employee based on designs and techniques and is broken down between 1,500 hours Landscape Maintenance Worker at $11/hr, 500 hours of Professional Worker at $65/hr, and 80 hours of Landscape Operator at $47/hr. Labor information was retrieved from State of California Department of Industrial Relations. There are no recreation trails in the Without Project Alternative. The With Project miles of recreation trails provided by Vandermost Consulting Services, Inc. Wetland and upland habitat acreage for the With Project Alternative provided by Vandermost Consulting Services, Inc.

Description of potential other benefits:

As stated above, the other benefits of the With Project Alternative include zero energy usage requirements, which in turn produces no GHG emissions. Maintenance estimates are ½ of what would be required for the Without Project Alternative. Open space benefits for the With Project Alternative include 2.5 miles of recreational trails, nine acres of wetland habitat, and 23 acres of upland habitat for wildlife, including endangered species.

Description of the distribution of local, regional, and statewide benefits, as applicable:

The With Project Alternative addresses the entire upstream watershed, approximately 10 times the treated area of the Without Project Alternative. As Low Impact Development and other activities are implemented upstream, the efficiency of the system will be greater. Regional facilities assist with the mitigation of other environmental impacts such as vector control, allowing professional agencies monitor and address vectors in a manner that would not be possible in the Without Project Alternative. The annual treatment and capture volume is significantly higher due to the location and hydraulics of the

With Project Alternative, providing local, regional, and potentially statewide benefits, should it become a model for future activities.

Identification of beneficiaries:

The With Project Alternative beneficiaries and stakeholders include: City of Ontario (lead agency), City of Chino, County of San Bernardino, Inland Empire Utilities Agencies (IEUA), Orange County Water District (OCWD), United States Army Corps of Engineers (USACE). The With Project Alternative transforms a fallow and underutilized area into a destination providing environmental, recreational and educational benefits consistent with the USACE Prado Basin Master Plan, The Chino Preserve Specific Plan, The City of Chino Urban Buffer Plan trail connections, The County of San Bernardino planned future trail connections, and Regional Water Quality Control Board water quality objectives. The Project also serves to satisfy the intent of the storm water run-off provisions of the Clean Water Act.

When the benefits will be received:

The benefits, according to Table 16, would begin accruing in 2011 and continue for the 50-year expected life of the project. Construction of the actual project is scheduled to be completed in 2012 so the benefits would begin accruing in 2014.

Uncertainty of Benefits:

Uncertainties associated with the benefits are primarily linked to hydrologic variability and future conditions in the watershed. Performance measures and benefits were calculated on an average annual basis because of year-to-year variability of rainfall. Future conditions in the watershed could include the transitioning of land uses, changes in development practices, and changes to dry-weather flow sources. Variability in maintenance practices will be a function of desired aesthetics and vector control; maintenance of the facility for water quality and hydraulic performance should be relatively consistent, by design, for the system. Uncertainties on GHG emissions are associated with EPA’s 2005 eGrid and pump energy usage estimates.

Description of any adverse effects:

Potential adverse effects would likely be temporary disruptions during construction, all of which should be adequately mitigated by contractor activities.

Table 16 - Water Quality and Other Expected Benefits (All benefits in col. j in 2009 dollars) Project: Cucamonga Creek Watershed Regional Water Quality Project									
(a)	(b)	(c)	(d)	(e)	(f)	(g)	(h)	(i)	(j)
Year	Type of Benefit	Measure of Benefit (Units)	Without Project	With Project	Change Resulting from Project (e) – (d)	Unit $ Value (1)	Annual $ Value (f) x (g) (1)	Discount Factor (1)	Discounted Benefits (h) x (i) (1)
2009	Construction (yr 1)	DOLLARS	**-$16,781,000**	**-$10,825,000**	**$5,956,000**	**$1.00**	**$5,956,000**	**1.000**	**$5,956,000**
	Construction GHG (yr 1)	TONS	**-1,400**	**-1,400**	**0**				
2010	Construction (yr 2)	DOLLARS	**-$16,781,000**	**-$10,825,000**	**$5,956,000**	**$1.00**	**$5,956,000**	**0.943**	**$5,616,508**
	Construction GHG (yr 2)	TONS	**-1,400**	**-1,400**	**0**				
2011	Water Quality (wet weather)	ACRE-FEET	**1520**	**4200**	**2,680**	**$200.00**	**$536,000**	**0.890**	**$477,040**
2011	Water Quality (dry weather)	ACRE-FEET	**700**	**2700**	**2,000**	**$200.00**	**$400,000**	**0.890**	**$356,000**
2011	Electricity Usage	KWH	**-55000**	**0**	**55,000**	**$0.13**	**$7,150**	**0.890**	**$6,364**
2011	Maintenance Effort	HOURS	**-4,160**	**-2,080**	**2,080**	**$25.00**	**$52,000**	**0.890**	**$46,280**
2011	Recreation Trails	MILES	**0**	**2.5**	**2.5**				
2011	Wetland Habitat	ACRES	**0**	**9**	**9**				
2011	Upland Habitat	ACRES	**0**	**23**	**23**				
2011	GHG Emissions	TONS	**-15**	**0**	**15**				
2012	Water Quality (wet weather)	ACRE-FEET	**1520**	**4200**	**2,680**	**$200.00**	**$536,000**	**0.840**	**$450,240**
2012	Water Quality (dry weather)	ACRE-FEET	**700**	**2700**	**2,000**	**$200.00**	**$400,000**	**0.840**	**$336,000**
2012	Electricity Usage	KWH	**-55000**	**0**	**55,000**	**$0.13**	**$7,150**	**0.840**	**$6,006**
2012	Maintenance Effort	HOURS	**-4,160**	**-2,080**	**2,080**	**$25.00**	**$52,000**	**0.840**	**$43,680**
2012	Recreation Trails	MILES	**0**	**2.5**	**2.5**				
2012	Wetland Habitat	ACRES	**0**	**9**	**9**				
2012	Upland Habitat	ACRES	**0**	**23**	**23**				
2012	GHG Emissions	TONS	**-15**	**0**	**15**				
2013	Water Quality (wet weather)	ACRE-FEET	**1520**	**4200**	**2,680**	**$200.00**	**$536,000**	**0.792**	**$424,512**
2013	Water Quality (dry weather)	ACRE-FEET	**700**	**2700**	**2,000**	**$200.00**	**$400,000**	**0.792**	**$316,800**
2013	Electricity Usage	KWH	**-55000**	**0**	**55,000**	**$0.13**	**$7,150**	**0.792**	**$5,663**
2013	Maintenance Effort	HOURS	**-4,160**	**-2,080**	**2,080**	**$25.00**	**$52,000**	**0.792**	**$41,184**
2013	Recreation Trails	MILES	**0**	**2.5**	**2.5**				
2013	Wetland Habitat	ACRES	**0**	**9**	**9**				
2013	Upland Habitat	ACRES	**0**	**23**	**23**				
2013	GHG Emissions	TONS	**-15**	**0**	**15**				
2014	Water Quality (wet weather)	ACRE-FEET	**1520**	**4200**	**2,680**	**$200.00**	**$536,000**	**0.747**	**$400,392**
2014	Water Quality (dry weather)	ACRE-FEET	**700**	**2700**	**2,000**	**$200.00**	**$400,000**	**0.747**	**$298,800**
2014	Electricity Usage	KWH	**-55000**	**0**	**55,000**	**$0.13**	**$7,150**	**0.747**	**$5,341**
2014	Maintenance Effort	HOURS	**-4,160**	**-2,080**	**2,080**	**$25.00**	**$52,000**	**0.747**	**$38,844**

Table 16 - Water Quality and Other Expected Benefits (All benefits in col. j in 2009 dollars) Project: Cucamonga Creek Watershed Regional Water Quality Project									
(a)	(b)	(c)	(d)	(e)	(f)	(g)	(h)	(i)	(j)
Year	Type of Benefit	Measure of Benefit (Units)	Without Project	With Project	Change Resulting from Project (e) – (d)	Unit $ Value (1)	Annual $ Value (f) x (g) (1)	Discount Factor (1)	Discounted Benefits (h) x (i) (1)
2014	Recreation Trails	MILES	0	2.5	2.5				
2014	Wetland Habitat	ACRES	0	9	9				
2014	Upland Habitat	ACRES	0	23	23				
2014	GHG Emissions	TONS	-15	0	15				
2015	Water Quality (wet weather)	ACRE-FEET	**1520**	**4200**	**2,680**	**$200.00**	**$536,000**	**0.705**	**$377,880**
2015	Water Quality (dry weather)	ACRE-FEET	**700**	**2700**	**2,000**	**$200.00**	**$400,000**	**0.705**	**$282,000**
2015	Electricity Usage	KWH	**-55000**	**0**	**55,000**	**$0.13**	**$7,150**	**0.705**	**$5,041**
2015	Maintenance Effort	HOURS	**-4,160**	**-2,080**	**2,080**	**$25.00**	**$52,000**	**0.705**	**$36,660**
2015	Recreation Trails	MILES	**0**	**2.5**	**2.5**				
2015	Wetland Habitat	ACRES	**0**	**9**	**9**				
2015	Upland Habitat	ACRES	**0**	**23**	**23**				
2015	GHG Emissions	TONS	**-15**	**0**	**15**				
2016	Water Quality (wet weather)	ACRE-FEET	**1520**	**4200**	**2,680**	**$200.00**	**$536,000**	**0.665**	**$356,440**
2016	Water Quality (dry weather)	ACRE-FEET	**700**	**2700**	**2,000**	**$200.00**	**$400,000**	**0.665**	**$266,000**
2016	Electricity Usage	KWH	**-55000**	**0**	**55,000**	**$0.13**	**$7,150**	**0.665**	**$4,755**
2016	Maintenance Effort	HOURS	**-4,160**	**-2,080**	**2,080**	**$25.00**	**$52,000**	**0.665**	**$34,580**
2016	Recreation Trails	MILES	**0**	**2.5**	**2.5**				
2016	Wetland Habitat	ACRES	**0**	**9**	**9**				
2016	Upland Habitat	ACRES	**0**	**23**	**23**				
2016	GHG Emissions	TONS	**-15**	**0**	**15**				
2017	Water Quality (wet weather)	ACRE-FEET	**1520**	**4200**	**2,680**	**$200.00**	**$536,000**	**0.627**	**$336,072**
2017	Water Quality (dry weather)	ACRE-FEET	**700**	**2700**	**2,000**	**$200.00**	**$400,000**	**0.627**	**$250,800**
2017	Electricity Usage	KWH	**-55000**	**0**	**55,000**	**$0.13**	**$7,150**	**0.627**	**$4,483**
2017	Maintenance Effort	HOURS	**-4,160**	**-2,080**	**2,080**	**$25.00**	**$52,000**	**0.627**	**$32,604**
2017	Recreation Trails	MILES	**0**	**2.5**	**2.5**				
2017	Wetland Habitat	ACRES	**0**	**9**	**9**				
2017	Upland Habitat	ACRES	**0**	**23**	**23**				
2017	GHG Emissions	TONS	**-15**	**0**	**15**				
2018	Water Quality (wet weather)	ACRE-FEET	**1520**	**4200**	**2,680**	**$200.00**	**$536,000**	**0.592**	**$317,312**
2018	Water Quality (dry weather)	ACRE-FEET	**700**	**2700**	**2,000**	**$200.00**	**$400,000**	**0.592**	**$236,800**
2018	Electricity Usage	KWH	**-55000**	**0**	**55,000**	**$0.13**	**$7,150**	**0.592**	**$4,233**
2018	Maintenance Effort	HOURS	**-4,160**	**-2,080**	**2,080**	**$25.00**	**$52,000**	**0.592**	**$30,784**
2018	Recreation Trails	MILES	**0**	**2.5**	**2.5**				
2018	Wetland Habitat	ACRES	**0**	**9**	**9**				

Table 16 - Water Quality and Other Expected Benefits (All benefits in col. j in 2009 dollars) Project: Cucamonga Creek Watershed Regional Water Quality Project									
(a)	(b)	(c)	(d)	(e)	(f)	(g)	(h)	(i)	(j)
Year	Type of Benefit	Measure of Benefit (Units)	Without Project	With Project	Change Resulting from Project (e) – (d)	Unit $ Value (1)	Annual $ Value (f) x (g) (1)	Discount Factor (1)	Discounted Benefits (h) x (i) (1)
2018	Upland Habitat	ACRES	**0**	**23**	**23**				
2018	GHG Emissions	TONS	**-15**	**0**	**15**				
2019	Water Quality (wet weather)	ACRE-FEET	**1520**	**4200**	**2,680**	**$200.00**	**$536,000**	**0.558**	**$299,088**
2019	Water Quality (dry weather)	ACRE-FEET	**700**	**2700**	**2,000**	**$200.00**	**$400,000**	**0.558**	**$223,200**
2019	Electricity Usage	KWH	**-55000**	**0**	**55,000**	**$0.13**	**$7,150**	**0.558**	**$3,990**
2019	Maintenance Effort	HOURS	**-4,160**	**-2,080**	**2,080**	**$25.00**	**$52,000**	**0.558**	**$29,016**
2019	Recreation Trails	MILES	**0**	**2.5**	**2.5**				
2019	Wetland Habitat	ACRES	**0**	**9**	**9**				
2019	Upland Habitat	ACRES	**0**	**23**	**23**				
2019	GHG Emissions	TONS	**-15**	**0**	**15**				
2020	Water Quality (wet weather)	ACRE-FEET	**1520**	**4200**	**2,680**	**$200.00**	**$536,000**	**0.527**	**$282,472**
2020	Water Quality (dry weather)	ACRE-FEET	**700**	**2700**	**2,000**	**$200.00**	**$400,000**	**0.527**	**$210,800**
2020	Electricity Usage	KWH	**-55000**	**0**	**55,000**	**$0.13**	**$7,150**	**0.527**	**$3,768**
2020	Maintenance Effort	HOURS	**-4,160**	**-2,080**	**2,080**	**$25.00**	**$52,000**	**0.527**	**$27,404**
2020	Recreation Trails	MILES	**0**	**2.5**	**2.5**				
2020	Wetland Habitat	ACRES	**0**	**9**	**9**				
2020	Upland Habitat	ACRES	**0**	**23**	**23**				
2020	GHG Emissions	TONS	**-15**	**0**	**15**				
2021	Water Quality (wet weather)	ACRE-FEET	**1520**	**4200**	**2,680**	**$200.00**	**$536,000**	**0.497**	**$266,392**
2021	Water Quality (dry weather)	ACRE-FEET	**700**	**2700**	**2,000**	**$200.00**	**$400,000**	**0.497**	**$198,800**
2021	Electricity Usage	KWH	**-55000**	**0**	**55,000**	**$0.13**	**$7,150**	**0.497**	**$3,554**
2021	Maintenance Effort	HOURS	**-4,160**	**-2,080**	**2,080**	**$25.00**	**$52,000**	**0.497**	**$25,844**
2021	Recreation Trails	MILES	**0**	**2.5**	**2.5**				
2021	Wetland Habitat	ACRES	**0**	**9**	**9**				
2021	Upland Habitat	ACRES	**0**	**23**	**23**				
2021	GHG Emissions	TONS	**-15**	**0**	**15**				
2022	Water Quality (wet weather)	ACRE-FEET	**1520**	**4200**	**2,680**	**$200.00**	**$536,000**	**0.469**	**$251,384**
2022	Water Quality (dry weather)	ACRE-FEET	**700**	**2700**	**2,000**	**$200.00**	**$400,000**	**0.469**	**$187,600**
2022	Electricity Usage	KWH	**-55000**	**0**	**55,000**	**$0.13**	**$7,150**	**0.469**	**$3,353**
2022	Maintenance Effort	HOURS	**-4,160**	**-2,080**	**2,080**	**$25.00**	**$52,000**	**0.469**	**$24,388**
2022	Recreation Trails	MILES	**0**	**2.5**	**2.5**				
2022	Wetland Habitat	ACRES	**0**	**9**	**9**				
2022	Upland Habitat	ACRES	**0**	**23**	**23**				
2022	GHG Emissions	TONS	**-15**	**0**	**15**				

Table 16 - Water Quality and Other Expected Benefits (All benefits in col. j in 2009 dollars) Project: Cucamonga Creek Watershed Regional Water Quality Project									
(a)	(b)	(c)	(d)	(e)	(f)	(g)	(h)	(i)	(j)
Year	Type of Benefit	Measure of Benefit (Units)	Without Project	With Project	Change Resulting from Project (e) – (d)	Unit $ Value (1)	Annual $ Value (f) x (g) (1)	Discount Factor (1)	Discounted Benefits (h) x (i) (1)
2023	Water Quality (wet weather)	ACRE-FEET	**1520**	**4200**	**2,680**	**$200.00**	**$536,000**	**0.442**	**$236,912**
2023	Water Quality (dry weather)	ACRE-FEET	**700**	**2700**	**2,000**	**$200.00**	**$400,000**	**0.442**	**$176,800**
2023	Electricity Usage	KWH	**-55000**	**0**	**55,000**	**$0.13**	**$7,150**	**0.442**	**$3,160**
2023	Maintenance Effort	HOURS	**-4,160**	**-2,080**	**2,080**	**$25.00**	**$52,000**	**0.442**	**$22,984**
2023	Recreation Trails	MILES	**0**	**2.5**	**2.5**				
2023	Wetland Habitat	ACRES	**0**	**9**	**9**				
2023	Upland Habitat	ACRES	**0**	**23**	**23**				
2023	GHG Emissions	TONS	**-15**	**0**	**15**				
2024	Water Quality (wet weather)	ACRE-FEET	**1520**	**4200**	**2,680**	**$200.00**	**$536,000**	**0.417**	**$223,512**
2024	Water Quality (dry weather)	ACRE-FEET	**700**	**2700**	**2,000**	**$200.00**	**$400,000**	**0.417**	**$166,800**
2024	Electricity Usage	KWH	**-55000**	**0**	**55,000**	**$0.13**	**$7,150**	**0.417**	**$2,982**
2024	Maintenance Effort	HOURS	**-4,160**	**-2,080**	**2,080**	**$25.00**	**$52,000**	**0.417**	**$21,684**
2024	Recreation Trails	MILES	**0**	**2.5**	**2.5**				
2024	Wetland Habitat	ACRES	**0**	**9**	**9**				
2024	Upland Habitat	ACRES	**0**	**23**	**23**				
2024	GHG Emissions	TONS	**-15**	**0**	**15**				
2025	Water Quality (wet weather)	ACRE-FEET	**1520**	**4200**	**2,680**	**$200.00**	**$536,000**	**0.394**	**$211,184**
2025	Water Quality (dry weather)	ACRE-FEET	**700**	**2700**	**2,000**	**$200.00**	**$400,000**	**0.394**	**$157,600**
2025	Electricity Usage	KWH	**-55000**	**0**	**55,000**	**$0.13**	**$7,150**	**0.394**	**$2,817**
2025	Maintenance Effort	HOURS	**-4,160**	**-2,080**	**2,080**	**$25.00**	**$52,000**	**0.394**	**$20,488**
2025	Recreation Trails	MILES	**0**	**2.5**	**2.5**				
2025	Wetland Habitat	ACRES	**0**	**9**	**9**				
2025	Upland Habitat	ACRES	**0**	**23**	**23**				
2025	GHG Emissions	TONS	**-15**	**0**	**15**				
2026	Water Quality (wet weather)	ACRE-FEET	**1520**	**4200**	**2,680**	**$200.00**	**$536,000**	**0.371**	**$198,856**
2026	Water Quality (dry weather)	ACRE-FEET	**700**	**2700**	**2,000**	**$200.00**	**$400,000**	**0.371**	**$148,400**
2026	Electricity Usage	KWH	**-55000**	**0**	**55,000**	**$0.13**	**$7,150**	**0.371**	**$2,653**
2026	Maintenance Effort	HOURS	**-4,160**	**-2,080**	**2,080**	**$25.00**	**$52,000**	**0.371**	**$19,292**
2026	Recreation Trails	MILES	**0**	**2.5**	**2.5**				
2026	Wetland Habitat	ACRES	**0**	**9**	**9**				
2026	Upland Habitat	ACRES	**0**	**23**	**23**				
2026	GHG Emissions	TONS	**-15**	**0**	**15**				
2027	Water Quality (wet weather)	ACRE-FEET	**1520**	**4200**	**2,680**	**$200.00**	**$536,000**	**0.350**	**$187,600**

Table 16 - Water Quality and Other Expected Benefits (All benefits in col. j in 2009 dollars) Project: Cucamonga Creek Watershed Regional Water Quality Project									
(a)	(b)	(c)	(d)	(e)	(f)	(g)	(h)	(i)	(j)
Year	Type of Benefit	Measure of Benefit (Units)	Without Project	With Project	Change Resulting from Project (e) – (d)	Unit $ Value (1)	Annual $ Value (f) x (g) (1)	Discount Factor (1)	Discounted Benefits (h) x (i) (1)
2027	Water Quality (dry weather)	ACRE-FEET	700	2700	2,000	$200.00	$400,000	0.350	$140,000
2027	Electricity Usage	KWH	-55000	0	55,000	$0.13	$7,150	0.350	$2,503
2027	Maintenance Effort	HOURS	-4,160	-2,080	2,080	$25.00	$52,000	0.350	$18,200
2027	Recreation Trails	MILES	0	2.5	2.5				
2027	Wetland Habitat	ACRES	0	9	9				
2027	Upland Habitat	ACRES	0	23	23				
2027	GHG Emissions	TONS	-15	0	15				
2028	Water Quality (wet weather)	ACRE-FEET	1520	4200	2,680	$200.00	$536,000	0.331	$177,416
2028	Water Quality (dry weather)	ACRE-FEET	700	2700	2,000	$200.00	$400,000	0.331	$132,400
2028	Electricity Usage	KWH	-55000	0	55,000	$0.13	$7,150	0.331	$2,367
2028	Maintenance Effort	HOURS	-4,160	-2,080	2,080	$25.00	$52,000	0.331	$17,212
2028	Recreation Trails	MILES	0	2.5	2.5				
2028	Wetland Habitat	ACRES	0	9	9				
2028	Upland Habitat	ACRES	0	23	23				
2028	GHG Emissions	TONS	-15	0	15				
2029	Water Quality (wet weather)	ACRE-FEET	1520	4200	2,680	$200.00	$536,000	0.312	$167,232
2029	Water Quality (dry weather)	ACRE-FEET	700	2700	2,000	$200.00	$400,000	0.312	$124,800
2029	Electricity Usage	KWH	-55000	0	55,000	$0.13	$7,150	0.312	$2,231
2029	Maintenance Effort	HOURS	-4,160	-2,080	2,080	$25.00	$52,000	0.312	$16,224
2029	Recreation Trails	MILES	0	2.5	2.5				
2029	Wetland Habitat	ACRES	0	9	9				
2029	Upland Habitat	ACRES	0	23	23				
2029	GHG Emissions	TONS	-15	0	15				
2030	Water Quality (wet weather)	ACRE-FEET	1520	4200	2,680	$200.00	$536,000	0.294	$157,584
2030	Water Quality (dry weather)	ACRE-FEET	700	2700	2,000	$200.00	$400,000	0.294	$117,600
2030	Electricity Usage	KWH	-55000	0	55,000	$0.13	$7,150	0.294	$2,102
2030	Maintenance Effort	HOURS	-4,160	-2,080	2,080	$25.00	$52,000	0.294	$15,288
2030	Recreation Trails	MILES	0	2.5	2.5				
2030	Wetland Habitat	ACRES	0	9	9				
2030	Upland Habitat	ACRES	0	23	23				
2030	GHG Emissions	TONS	-15	0	15				
2031	Water Quality (wet weather)	ACRE-FEET	1520	4200	2,680	$200.00	$536,000	0.278	$149,008
2031	Water Quality (dry weather)	ACRE-FEET	700	2700	2,000	$200.00	$400,000	0.278	$111,200
2031	Electricity Usage	KWH	-55000	0	55,000	$0.13	$7,150	0.278	$1,988

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(a)	(b)	(c)	(d)	(e)	(f)	(g)	(h)	(i)	(j)
Year	Type of Benefit	Measure of Benefit (Units)	Without Project	With Project	Change Resulting from Project (e) – (d)	Unit $ Value (1)	Annual $ Value (f) x (g) (1)	Discount Factor (1)	Discounted Benefits (h) x (i) (1)
2031	Maintenance Effort	HOURS	**-4,160**	**-2,080**	**2,080**	**$25.00**	**$52,000**	**0.278**	**$14,456**
2031	Recreation Trails	MILES	**0**	**2.5**	**2.5**				
2031	Wetland Habitat	ACRES	**0**	**9**	**9**				
2031	Upland Habitat	ACRES	**0**	**23**	**23**				
2031	GHG Emissions	TONS	**-15**	**0**	**15**				
2032	Water Quality (wet weather)	ACRE-FEET	**1520**	**4200**	**2,680**	**$200.00**	**$536,000**	**0.262**	**$140,432**
2032	Water Quality (dry weather)	ACRE-FEET	**700**	**2700**	**2,000**	**$200.00**	**$400,000**	**0.262**	**$104,800**
2032	Electricity Usage	KWH	**-55000**	**0**	**55,000**	**$0.13**	**$7,150**	**0.262**	**$1,873**
2032	Maintenance Effort	HOURS	**-4,160**	**-2,080**	**2,080**	**$25.00**	**$52,000**	**0.262**	**$13,624**
2032	Recreation Trails	MILES	**0**	**2.5**	**2.5**				
2032	Wetland Habitat	ACRES	**0**	**9**	**9**				
2032	Upland Habitat	ACRES	**0**	**23**	**23**				
2032	GHG Emissions	TONS	**-15**	**0**	**15**				
2033	Water Quality (wet weather)	ACRE-FEET	**1520**	**4200**	**2,680**	**$200.00**	**$536,000**	**0.247**	**$132,392**
2033	Water Quality (dry weather)	ACRE-FEET	**700**	**2700**	**2,000**	**$200.00**	**$400,000**	**0.247**	**$98,800**
2033	Electricity Usage	KWH	**-55000**	**0**	**55,000**	**$0.13**	**$7,150**	**0.247**	**$1,766**
2033	Maintenance Effort	HOURS	**-4,160**	**-2,080**	**2,080**	**$25.00**	**$52,000**	**0.247**	**$12,844**
2033	Recreation Trails	MILES	**0**	**2.5**	**2.5**				
2033	Wetland Habitat	ACRES	**0**	**9**	**9**				
2033	Upland Habitat	ACRES	**0**	**23**	**23**				
2033	GHG Emissions	TONS	**-15**	**0**	**15**				
2034	Water Quality (wet weather)	ACRE-FEET	**1520**	**4200**	**2,680**	**$200.00**	**$536,000**	**0.233**	**$124,888**
2034	Water Quality (dry weather)	ACRE-FEET	**700**	**2700**	**2,000**	**$200.00**	**$400,000**	**0.233**	**$93,200**
2034	Electricity Usage	KWH	**-55000**	**0**	**55,000**	**$0.13**	**$7,150**	**0.233**	**$1,666**
2034	Maintenance Effort	HOURS	**-4,160**	**-2,080**	**2,080**	**$25.00**	**$52,000**	**0.233**	**$12,116**
2034	Recreation Trails	MILES	**0**	**2.5**	**2.5**				
2034	Wetland Habitat	ACRES	**0**	**9**	**9**				
2034	Upland Habitat	ACRES	**0**	**23**	**23**				
2034	GHG Emissions	TONS	**-15**	**0**	**15**				
2035	Water Quality (wet weather)	ACRE-FEET	**1520**	**4200**	**2,680**	**$200.00**	**$536,000**	**0.220**	**$117,920**
2035	Water Quality (dry weather)	ACRE-FEET	**700**	**2700**	**2,000**	**$200.00**	**$400,000**	**0.220**	**$88,000**
2035	Electricity Usage	KWH	**-55000**	**0**	**55,000**	**$0.13**	**$7,150**	**0.220**	**$1,573**
2035	Maintenance Effort	HOURS	**-4,160**	**-2,080**	**2,080**	**$25.00**	**$52,000**	**0.220**	**$11,440**
2035	Recreation Trails	MILES	**0**	**2.5**	**2.5**				

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(a)	(b)	(c)	(d)	(e)	(f)	(g)	(h)	(i)	(j)
Year	Type of Benefit	Measure of Benefit (Units)	Without Project	With Project	Change Resulting from Project (e) – (d)	Unit $ Value (1)	Annual $ Value (f) x (g) (1)	Discount Factor (1)	Discounted Benefits (h) x (i) (1)
2035	Wetland Habitat	ACRES	**0**	**9**	**9**				
2035	Upland Habitat	ACRES	**0**	**23**	**23**				
2035	GHG Emissions	TONS	**-15**	**0**	**15**				
2036	Water Quality (wet weather)	ACRE-FEET	**1520**	**4200**	**2,680**	**$200.00**	**$536,000**	**0.207**	**$110,952**
2036	Water Quality (dry weather)	ACRE-FEET	**700**	**2700**	**2,000**	**$200.00**	**$400,000**	**0.207**	**$82,800**
2036	Electricity Usage	KWH	**-55000**	**0**	**55,000**	**$0.13**	**$7,150**	**0.207**	**$1,480**
2036	Maintenance Effort	HOURS	**-4,160**	**-2,080**	**2,080**	**$25.00**	**$52,000**	**0.207**	**$10,764**
2036	Recreation Trails	MILES	**0**	**2.5**	**2.5**				
2036	Wetland Habitat	ACRES	**0**	**9**	**9**				
2036	Upland Habitat	ACRES	**0**	**23**	**23**				
2036	GHG Emissions	TONS	**-15**	**0**	**15**				
2037	Water Quality (wet weather)	ACRE-FEET	**1520**	**4200**	**2,680**	**$200.00**	**$536,000**	**0.196**	**$105,056**
2037	Water Quality (dry weather)	ACRE-FEET	**700**	**2700**	**2,000**	**$200.00**	**$400,000**	**0.196**	**$78,400**
2037	Electricity Usage	KWH	**-55000**	**0**	**55,000**	**$0.13**	**$7,150**	**0.196**	**$1,401**
2037	Maintenance Effort	HOURS	**-4,160**	**-2,080**	**2,080**	**$25.00**	**$52,000**	**0.196**	**$10,192**
2037	Recreation Trails	MILES	**0**	**2.5**	**2.5**				
2037	Wetland Habitat	ACRES	**0**	**9**	**9**				
2037	Upland Habitat	ACRES	**0**	**23**	**23**				
2037	GHG Emissions	TONS	**-15**	**0**	**15**				
2038	Water Quality (wet weather)	ACRE-FEET	**1520**	**4200**	**2,680**	**$200.00**	**$536,000**	**0.185**	**$99,160**
2038	Water Quality (dry weather)	ACRE-FEET	**700**	**2700**	**2,000**	**$200.00**	**$400,000**	**0.185**	**$74,000**
2038	Electricity Usage	KWH	**-55000**	**0**	**55,000**	**$0.13**	**$7,150**	**0.185**	**$1,323**
2038	Maintenance Effort	HOURS	**-4,160**	**-2,080**	**2,080**	**$25.00**	**$52,000**	**0.185**	**$9,620**
2038	Recreation Trails	MILES	**0**	**2.5**	**2.5**				
2038	Wetland Habitat	ACRES	**0**	**9**	**9**				
2038	Upland Habitat	ACRES	**0**	**23**	**23**				
2038	GHG Emissions	TONS	**-15**	**0**	**15**				
2039	Water Quality (wet weather)	ACRE-FEET	**1520**	**4200**	**2,680**	**$200.00**	**$536,000**	**0.174**	**$93,264**
2039	Water Quality (dry weather)	ACRE-FEET	**700**	**2700**	**2,000**	**$200.00**	**$400,000**	**0.174**	**$69,600**
2039	Electricity Usage	KWH	**-55000**	**0**	**55,000**	**$0.13**	**$7,150**	**0.174**	**$1,244**
2039	Maintenance Effort	HOURS	**-4,160**	**-2,080**	**2,080**	**$25.00**	**$52,000**	**0.174**	**$9,048**
2039	Recreation Trails	MILES	**0**	**2.5**	**2.5**				
2039	Wetland Habitat	ACRES	**0**	**9**	**9**				
2039	Upland Habitat	ACRES	**0**	**23**	**23**				

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(a)	(b)	(c)	(d)	(e)	(f)	(g)	(h)	(i)	(j)
Year	Type of Benefit	Measure of Benefit (Units)	Without Project	With Project	Change Resulting from Project (e) – (d)	Unit $ Value (1)	Annual $ Value (f) x (g) (1)	Discount Factor (1)	Discounted Benefits (h) x (i) (1)
2039	GHG Emissions	TONS	-15	0	15				
2040	Water Quality (wet weather)	ACRE-FEET	**1520**	**4200**	**2,680**	**$200.00**	**$536,000**	**0.164**	**$87,904**
2040	Water Quality (dry weather)	ACRE-FEET	**700**	**2700**	**2,000**	**$200.00**	**$400,000**	**0.164**	**$65,600**
2040	Electricity Usage	KWH	**-55000**	**0**	**55,000**	**$0.13**	**$7,150**	**0.164**	**$1,173**
2040	Maintenance Effort	HOURS	**-4,160**	**-2,080**	**2,080**	**$25.00**	**$52,000**	**0.164**	**$8,528**
2040	Recreation Trails	MILES	**0**	**2.5**	**2.5**				
2040	Wetland Habitat	ACRES	**0**	**9**	**9**				
2040	Upland Habitat	ACRES	**0**	**23**	**23**				
2040	GHG Emissions	TONS	**-15**	**0**	**15**				
2041	Water Quality (wet weather)	ACRE-FEET	**1520**	**4200**	**2,680**	**$200.00**	**$536,000**	**0.155**	**$83,080**
2041	Water Quality (dry weather)	ACRE-FEET	**700**	**2700**	**2,000**	**$200.00**	**$400,000**	**0.155**	**$62,000**
2041	Electricity Usage	KWH	**-55000**	**0**	**55,000**	**$0.13**	**$7,150**	**0.155**	**$1,108**
2041	Maintenance Effort	HOURS	**-4,160**	**-2,080**	**2,080**	**$25.00**	**$52,000**	**0.155**	**$8,060**
2041	Recreation Trails	MILES	**0**	**2.5**	**2.5**				
2041	Wetland Habitat	ACRES	**0**	**9**	**9**				
2041	Upland Habitat	ACRES	**0**	**23**	**23**				
2041	GHG Emissions	TONS	**-15**	**0**	**15**				
2042	Water Quality (wet weather)	ACRE-FEET	**1520**	**4200**	**2,680**	**$200.00**	**$536,000**	**0.146**	**$78,256**
2042	Water Quality (dry weather)	ACRE-FEET	**700**	**2700**	**2,000**	**$200.00**	**$400,000**	**0.146**	**$58,400**
2042	Electricity Usage	KWH	**-55000**	**0**	**55,000**	**$0.13**	**$7,150**	**0.146**	**$1,044**
2042	Maintenance Effort	HOURS	**-4,160**	**-2,080**	**2,080**	**$25.00**	**$52,000**	**0.146**	**$7,592**
2042	Recreation Trails	MILES	**0**	**2.5**	**2.5**				
2042	Wetland Habitat	ACRES	**0**	**9**	**9**				
2042	Upland Habitat	ACRES	**0**	**23**	**23**				
2042	GHG Emissions	TONS	**-15**	**0**	**15**				
2043	Water Quality (wet weather)	ACRE-FEET	**1520**	**4200**	**2,680**	**$200.00**	**$536,000**	**0.138**	**$73,968**
2043	Water Quality (dry weather)	ACRE-FEET	**700**	**2700**	**2,000**	**$200.00**	**$400,000**	**0.138**	**$55,200**
2043	Electricity Usage	KWH	**-55000**	**0**	**55,000**	**$0.13**	**$7,150**	**0.138**	**$987**
2043	Maintenance Effort	HOURS	**-4,160**	**-2,080**	**2,080**	**$25.00**	**$52,000**	**0.138**	**$7,176**
2043	Recreation Trails	MILES	**0**	**2.5**	**2.5**				
2043	Wetland Habitat	ACRES	**0**	**9**	**9**				
2043	Upland Habitat	ACRES	**0**	**23**	**23**				
2043	GHG Emissions	TONS	**-15**	**0**	**15**				
2044	Water Quality (wet weather)	ACRE-FEET	**1520**	**4200**	**2,680**	**$200.00**	**$536,000**	**0.130**	**$69,680**

Table 16 - Water Quality and Other Expected Benefits (All benefits in col. j in 2009 dollars) Project: Cucamonga Creek Watershed Regional Water Quality Project									
(a)	(b)	(c)	(d)	(e)	(f)	(g)	(h)	(i)	(j)
Year	Type of Benefit	Measure of Benefit (Units)	Without Project	With Project	Change Resulting from Project (e) – (d)	Unit $ Value (1)	Annual $ Value (f) x (g) (1)	Discount Factor (1)	Discounted Benefits (h) x (i) (1)
2044	Water Quality (dry weather)	ACRE-FEET	**700**	**2700**	**2,000**	**$200.00**	**$400,000**	**0.130**	**$52,000**
2044	Electricity Usage	KWH	**-55000**	**0**	**55,000**	**$0.13**	**$7,150**	**0.130**	**$930**
2044	Maintenance Effort	HOURS	**-4,160**	**-2,080**	**2,080**	**$25.00**	**$52,000**	**0.130**	**$6,760**
2044	Recreation Trails	MILES	**0**	**2.5**	**2.5**				
2044	Wetland Habitat	ACRES	**0**	**9**	**9**				
2044	Upland Habitat	ACRES	**0**	**23**	**23**				
2044	GHG Emissions	TONS	**-15**	**0**	**15**				
2045	Water Quality (wet weather)	ACRE-FEET	**1520**	**4200**	**2,680**	**$200.00**	**$536,000**	**0.123**	**$65,928**
2045	Water Quality (dry weather)	ACRE-FEET	**700**	**2700**	**2,000**	**$200.00**	**$400,000**	**0.123**	**$49,200**
2045	Electricity Usage	KWH	**-55000**	**0**	**55,000**	**$0.13**	**$7,150**	**0.123**	**$879**
2045	Maintenance Effort	HOURS	**-4,160**	**-2,080**	**2,080**	**$25.00**	**$52,000**	**0.123**	**$6,396**
2045	Recreation Trails	MILES	**0**	**2.5**	**2.5**				
2045	Wetland Habitat	ACRES	**0**	**9**	**9**				
2045	Upland Habitat	ACRES	**0**	**23**	**23**				
2045	GHG Emissions	TONS	**-15**	**0**	**15**				
2046	Water Quality (wet weather)	ACRE-FEET	**1520**	**4200**	**2,680**	**$200.00**	**$536,000**	**0.116**	**$62,176**
2046	Water Quality (dry weather)	ACRE-FEET	**700**	**2700**	**2,000**	**$200.00**	**$400,000**	**0.116**	**$46,400**
2046	Electricity Usage	KWH	**-55000**	**0**	**55,000**	**$0.13**	**$7,150**	**0.116**	**$829**
2046	Maintenance Effort	HOURS	**-4,160**	**-2,080**	**2,080**	**$25.00**	**$52,000**	**0.116**	**$6,032**
2046	Recreation Trails	MILES	**0**	**2.5**	**2.5**				
2046	Wetland Habitat	ACRES	**0**	**9**	**9**				
2046	Upland Habitat	ACRES	**0**	**23**	**23**				
2046	GHG Emissions	TONS	**-15**	**0**	**15**				
2047	Water Quality (wet weather)	ACRE-FEET	**1520**	**4200**	**2,680**	**$200.00**	**$536,000**	**0.109**	**$58,424**
2047	Water Quality (dry weather)	ACRE-FEET	**700**	**2700**	**2,000**	**$200.00**	**$400,000**	**0.109**	**$43,600**
2047	Electricity Usage	KWH	**-55000**	**0**	**55,000**	**$0.13**	**$7,150**	**0.109**	**$779**
2047	Maintenance Effort	HOURS	**-4,160**	**-2,080**	**2,080**	**$25.00**	**$52,000**	**0.109**	**$5,668**
2047	Recreation Trails	MILES	**0**	**2.5**	**2.5**				
2047	Wetland Habitat	ACRES	**0**	**9**	**9**				
2047	Upland Habitat	ACRES	**0**	**23**	**23**				
2047	GHG Emissions	TONS	**-15**	**0**	**15**				
2048	Water Quality (wet weather)	ACRE-FEET	**1520**	**4200**	**2,680**	**$200.00**	**$536,000**	**0.103**	**$55,208**
2048	Water Quality (dry weather)	ACRE-FEET	**700**	**2700**	**2,000**	**$200.00**	**$400,000**	**0.103**	**$41,200**
2048	Electricity Usage	KWH	**-55000**	**0**	**55,000**	**$0.13**	**$7,150**	**0.103**	**$736**

Table 16 - Water Quality and Other Expected Benefits (All benefits in col. j in 2009 dollars) Project: Cucamonga Creek Watershed Regional Water Quality Project									
(a)	(b)	(c)	(d)	(e)	(f)	(g)	(h)	(i)	(j)
Year	Type of Benefit	Measure of Benefit (Units)	Without Project	With Project	Change Resulting from Project (e) – (d)	Unit $ Value (1)	Annual $ Value (f) x (g) (1)	Discount Factor (1)	Discounted Benefits (h) x (i) (1)
2048	Maintenance Effort	HOURS	**-4,160**	**-2,080**	**2,080**	**$25.00**	**$52,000**	**0.103**	**$5,356**
2048	Recreation Trails	MILES	**0**	**2.5**	**2.5**				
2048	Wetland Habitat	ACRES	**0**	**9**	**9**				
2048	Upland Habitat	ACRES	**0**	**23**	**23**				
2048	GHG Emissions	TONS	**-15**	**0**	**15**				
2049	Water Quality (wet weather)	ACRE-FEET	**1520**	**4200**	**2,680**	**$200.00**	**$536,000**	**0.097**	**$51,992**
2049	Water Quality (dry weather)	ACRE-FEET	**700**	**2700**	**2,000**	**$200.00**	**$400,000**	**0.097**	**$38,800**
2049	Electricity Usage	KWH	**-55000**	**0**	**55,000**	**$0.13**	**$7,150**	**0.097**	**$694**
2049	Maintenance Effort	HOURS	**-4,160**	**-2,080**	**2,080**	**$25.00**	**$52,000**	**0.097**	**$5,044**
2049	Recreation Trails	MILES	**0**	**2.5**	**2.5**				
2049	Wetland Habitat	ACRES	**0**	**9**	**9**				
2049	Upland Habitat	ACRES	**0**	**23**	**23**				
2049	GHG Emissions	TONS	**-15**	**0**	**15**				
2050	Water Quality (wet weather)	ACRE-FEET	**1520**	**4200**	**2,680**	**$200.00**	**$536,000**	**0.092**	**$49,312**
2050	Water Quality (dry weather)	ACRE-FEET	**700**	**2700**	**2,000**	**$200.00**	**$400,000**	**0.092**	**$36,800**
2050	Electricity Usage	KWH	**-55000**	**0**	**55,000**	**$0.13**	**$7,150**	**0.092**	**$658**
2050	Maintenance Effort	HOURS	**-4,160**	**-2,080**	**2,080**	**$25.00**	**$52,000**	**0.092**	**$4,784**
2050	Recreation Trails	MILES	**0**	**2.5**	**2.5**				
2050	Wetland Habitat	ACRES	**0**	**9**	**9**				
2050	Upland Habitat	ACRES	**0**	**23**	**23**				
2050	GHG Emissions	TONS	**-15**	**0**	**15**				
2051	Water Quality (wet weather)	ACRE-FEET	**1520**	**4200**	**2,680**	**$200.00**	**$536,000**	**0.087**	**$46,632**
2051	Water Quality (dry weather)	ACRE-FEET	**700**	**2700**	**2,000**	**$200.00**	**$400,000**	**0.087**	**$34,800**
2051	Electricity Usage	KWH	**-55000**	**0**	**55,000**	**$0.13**	**$7,150**	**0.087**	**$622**
2051	Maintenance Effort	HOURS	**-4,160**	**-2,080**	**2,080**	**$25.00**	**$52,000**	**0.087**	**$4,524**
2051	Recreation Trails	MILES	**0**	**2.5**	**2.5**				
2051	Wetland Habitat	ACRES	**0**	**9**	**9**				
2051	Upland Habitat	ACRES	**0**	**23**	**23**				
2051	GHG Emissions	TONS	**-15**	**0**	**15**				
2052	Water Quality (wet weather)	ACRE-FEET	**1520**	**4200**	**2,680**	**$200.00**	**$536,000**	**0.082**	**$43,952**
2052	Water Quality (dry weather)	ACRE-FEET	**700**	**2700**	**2,000**	**$200.00**	**$400,000**	**0.082**	**$32,800**
2052	Electricity Usage	KWH	**-55000**	**0**	**55,000**	**$0.13**	**$7,150**	**0.082**	**$586**
2052	Maintenance Effort	HOURS	**-4,160**	**-2,080**	**2,080**	**$25.00**	**$52,000**	**0.082**	**$4,264**
2052	Recreation Trails	MILES	**0**	**2.5**	**2.5**				

Table 16 - Water Quality and Other Expected Benefits (All benefits in col. j in 2009 dollars) Project: Cucamonga Creek Watershed Regional Water Quality Project									
(a)	(b)	(c)	(d)	(e)	(f)	(g)	(h)	(i)	(j)
Year	Type of Benefit	Measure of Benefit (Units)	Without Project	With Project	Change Resulting from Project (e) – (d)	Unit $ Value (1)	Annual $ Value (f) x (g) (1)	Discount Factor (1)	Discounted Benefits (h) x (i) (1)
2052	Wetland Habitat	ACRES	**0**	**9**	**9**				
2052	Upland Habitat	ACRES	**0**	**23**	**23**				
2052	GHG Emissions	TONS	**-15**	**0**	**15**				
2053	Water Quality (wet weather)	ACRE-FEET	**1520**	**4200**	**2,680**	**$200.00**	**$536,000**	**0.077**	**$41,272**
2053	Water Quality (dry weather)	ACRE-FEET	**700**	**2700**	**2,000**	**$200.00**	**$400,000**	**0.077**	**$30,800**
2053	Electricity Usage	KWH	**-55000**	**0**	**55,000**	**$0.13**	**$7,150**	**0.077**	**$551**
2053	Maintenance Effort	HOURS	**-4,160**	**-2,080**	**2,080**	**$25.00**	**$52,000**	**0.077**	**$4,004**
2053	Recreation Trails	MILES	**0**	**2.5**	**2.5**				
2053	Wetland Habitat	ACRES	**0**	**9**	**9**				
2053	Upland Habitat	ACRES	**0**	**23**	**23**				
2053	GHG Emissions	TONS	**-15**	**0**	**15**				
2054	Water Quality (wet weather)	ACRE-FEET	**1520**	**4200**	**2,680**	**$200.00**	**$536,000**	**0.073**	**$39,128**
2054	Water Quality (dry weather)	ACRE-FEET	**700**	**2700**	**2,000**	**$200.00**	**$400,000**	**0.073**	**$29,200**
2054	Electricity Usage	KWH	**-55000**	**0**	**55,000**	**$0.13**	**$7,150**	**0.073**	**$522**
2054	Maintenance Effort	HOURS	**-4,160**	**-2,080**	**2,080**	**$25.00**	**$52,000**	**0.073**	**$3,796**
2054	Recreation Trails	MILES	**0**	**2.5**	**2.5**				
2054	Wetland Habitat	ACRES	**0**	**9**	**9**				
2054	Upland Habitat	ACRES	**0**	**23**	**23**				
2054	GHG Emissions	TONS	**-15**	**0**	**15**				
2055	Water Quality (wet weather)	ACRE-FEET	**1520**	**4200**	**2,680**	**$200.00**	**$536,000**	**0.069**	**$36,984**
2055	Water Quality (dry weather)	ACRE-FEET	**700**	**2700**	**2,000**	**$200.00**	**$400,000**	**0.069**	**$27,600**
2055	Electricity Usage	KWH	**-55000**	**0**	**55,000**	**$0.13**	**$7,150**	**0.069**	**$493**
2055	Maintenance Effort	HOURS	**-4,160**	**-2,080**	**2,080**	**$25.00**	**$52,000**	**0.069**	**$3,588**
2055	Recreation Trails	MILES	**0**	**2.5**	**2.5**				
2055	Wetland Habitat	ACRES	**0**	**9**	**9**				
2055	Upland Habitat	ACRES	**0**	**23**	**23**				
2055	GHG Emissions	TONS	**-15**	**0**	**15**				
2056	Water Quality (wet weather)	ACRE-FEET	**1520**	**4200**	**2,680**	**$200.00**	**$536,000**	**0.065**	**$34,840**
2056	Water Quality (dry weather)	ACRE-FEET	**700**	**2700**	**2,000**	**$200.00**	**$400,000**	**0.065**	**$26,000**
2056	Electricity Usage	KWH	**-55000**	**0**	**55,000**	**$0.13**	**$7,150**	**0.065**	**$465**
2056	Maintenance Effort	HOURS	**-4,160**	**-2,080**	**2,080**	**$25.00**	**$52,000**	**0.065**	**$3,380**
2056	Recreation Trails	MILES	**0**	**2.5**	**2.5**				
2056	Wetland Habitat	ACRES	**0**	**9**	**9**				
2056	Upland Habitat	ACRES	**0**	**23**	**23**				

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(a)	(b)	(c)	(d)	(e)	(f)	(g)	(h)	(i)	(j)
Year	Type of Benefit	Measure of Benefit (Units)	Without Project	With Project	Change Resulting from Project (e) – (d)	Unit $ Value (1)	Annual $ Value (f) x (g) (1)	Discount Factor (1)	Discounted Benefits (h) x (i) (1)
2056	GHG Emissions	TONS	-15	0	15				
2057	Water Quality (wet weather)	ACRE-FEET	**1520**	**4200**	**2,680**	**$200.00**	**$536,000**	**0.061**	**$32,696**
2057	Water Quality (dry weather)	ACRE-FEET	**700**	**2700**	**2,000**	**$200.00**	**$400,000**	**0.061**	**$24,400**
2057	Electricity Usage	KWH	**-55000**	**0**	**55,000**	**$0.13**	**$7,150**	**0.061**	**$436**
2057	Maintenance Effort	HOURS	**-4,160**	**-2,080**	**2,080**	**$25.00**	**$52,000**	**0.061**	**$3,172**
2057	Recreation Trails	MILES	**0**	**2.5**	**2.5**				
2057	Wetland Habitat	ACRES	**0**	**9**	**9**				
2057	Upland Habitat	ACRES	**0**	**23**	**23**				
2057	GHG Emissions	TONS	**-15**	**0**	**15**				
2058	Water Quality (wet weather)	ACRE-FEET	**1520**	**4200**	**2,680**	**$200.00**	**$536,000**	**0.058**	**$31,088**
2058	Water Quality (dry weather)	ACRE-FEET	**700**	**2700**	**2,000**	**$200.00**	**$400,000**	**0.058**	**$23,200**
2058	Electricity Usage	KWH	**-55000**	**0**	**55,000**	**$0.13**	**$7,150**	**0.058**	**$415**
2058	Maintenance Effort	HOURS	**-4,160**	**-2,080**	**2,080**	**$25.00**	**$52,000**	**0.058**	**$3,016**
2058	Recreation Trails	MILES	**0**	**2.5**	**2.5**				
2058	Wetland Habitat	ACRES	**0**	**9**	**9**				
2058	Upland Habitat	ACRES	**0**	**23**	**23**				
2058	GHG Emissions	TONS	**-15**	**0**	**15**				
2059	Water Quality (wet weather)	ACRE-FEET	**1520**	**4200**	**2,680**	**$200.00**	**$536,000**	**0.055**	**$29,480**
2059	Water Quality (dry weather)	ACRE-FEET	**700**	**2700**	**2,000**	**$200.00**	**$400,000**	**0.055**	**$22,000**
2059	Electricity Usage	KWH	**-55000**	**0**	**55,000**	**$0.13**	**$7,150**	**0.055**	**$393**
2059	Maintenance Effort	HOURS	**-4,160**	**-2,080**	**2,080**	**$25.00**	**$52,000**	**0.055**	**$2,860**
2059	Recreation Trails	MILES	**0**	**2.5**	**2.5**				
2059	Wetland Habitat	ACRES	**0**	**9**	**9**				
2059	Upland Habitat	ACRES	**0**	**23**	**23**				
2059	GHG Emissions	TONS	**-15**	**0**	**15**				
2060	Water Quality (wet weather)	ACRE-FEET	**1520**	**4200**	**2,680**	**$200.00**	**$536,000**	**0.052**	**$27,872**
2060	Water Quality (dry weather)	ACRE-FEET	**700**	**2700**	**2,000**	**$200.00**	**$400,000**	**0.052**	**$20,800**
2060	Electricity Usage	KWH	**-55000**	**0**	**55,000**	**$0.13**	**$7,150**	**0.052**	**$372**
2060	Maintenance Effort	HOURS	**-4,160**	**-2,080**	**2,080**	**$25.00**	**$52,000**	**0.052**	**$2,704**
2060	Recreation Trails	MILES	**0**	**2.5**	**2.5**				
2060	Wetland Habitat	ACRES	**0**	**9**	**9**				
2060	Upland Habitat	ACRES	**0**	**23**	**23**				
2060	GHG Emissions	TONS	**-15**	**0**	**15**				
2061	Water Quality (wet weather)	ACRE-FEET	**1520**	**4200**	**2,680**	**$200.00**	**$536,000**	**0.050**	**$26,800**

Table 16 - Water Quality and Other Expected Benefits (All benefits in col. j in 2009 dollars) Project: Cucamonga Creek Watershed Regional Water Quality Project									
(a)	(b)	(c)	(d)	(e)	(f)	(g)	(h)	(i)	(j)
Year	Type of Benefit	Measure of Benefit (Units)	Without Project	With Project	Change Resulting from Project (e) – (d)	Unit $ Value (1)	Annual $ Value (f) x (g) (1)	Discount Factor (1)	Discounted Benefits (h) x (i) (1)
2061	Water Quality (dry weather)	ACRE-FEET	**700**	**2700**	**2,000**	**$200.00**	**$400,000**	**0.050**	**$20,000**
2061	Electricity Usage	KWH	**-55000**	**0**	**55,000**	**$0.13**	**$7,150**	**0.050**	**$358**
2061	Maintenance Effort	HOURS	**-4,160**	**-2,080**	**2,080**	**$25.00**	**$52,000**	**0.050**	**$2,600**
2061	Recreation Trails	MILES	**0**	**2.5**	**2.5**				
2061	Wetland Habitat	ACRES	**0**	**9**	**9**				
2061	Upland Habitat	ACRES	**0**	**23**	**23**				
2061	GHG Emissions	TONS	**-15**	**0**	**15**				

Total Present Value of Discounted Benefits Based on Unit Value (Sum of the values in Column (j) for all Benefits shown in table) Transfer to Table 20, column (f), Exhibit F: Proposal Costs and Benefits Summaries	$26,424,127

Comments: Over the life of the project, the reduction in GHG emissions by building the With Project Alternative, rather than the Without Project Alternative, is estimated at 750 tons of CO_2-eq.

Construction Costs (Without Project) - Estimates provided by NMC Builders, LLC
Construction Costs (With Project) - Estimates provided by NMC Builders, LLC
Construction GHG Emissions (Without Project) - Estimates from assumption that distributed design of the Without Project Alternative would cause slightly more GHGs to be emitted than the single site With Project Alternative (see citation below)
Construction GHG Emissions (With Project) - Calculations from Investigative Science and Engineering, Inc., 2008 titled Greenhouse Gas / Global Warming Risk Assessment, Mill Creek Wetlands Recreation and Restoration Demonstration Project, San Bernardino County CA
Wet and Dry-Weather Water Quality Benefits (Without Project) - Calculations provided by Geosyntec, 2009, Public Benefits to Water Quality - Cucamonga Creek Watershed Water Quality Project and the Ballona TMDL IP (City of Los Angeles, 2009)

Table 16 - Water Quality and Other Expected Benefits (All benefits in col. j in 2009 dollars) Project: Cucamonga Creek Watershed Regional Water Quality Project									
(a)	(b)	(c)	(d)	(e)	(f)	(g)	(h)	(i)	(j)
Year	Type of Benefit	Measure of Benefit (Units)	Without Project	With Project	Change Resulting from Project (e) – (d)	Unit $ Value (1)	Annual $ Value (f) x (g) (1)	Discount Factor (1)	Discounted Benefits (h) x (i) (1)

Wet and Dry-Weather Water Quality Benefits (With Project) - Calculations provided by Geosyntec, 2009, Public Benefits to Water Quality - Cucamonga Creek Watershed Water Quality Project and the Ballona TMDL IP (City of Los Angeles, 2009)
Energy Consumption in kWh (Without Project) - Calculations based 2.75 kWh/AF/foot (LADWP Communication, 2010)
Energy Consumption in kWh (With Project) - Gravity design eliminates need for pumps
GHG Emissions in tons of CO2-eq (Without Project) - Calculations based on energy consumption calculated above multiplied by 0.542 pounds of CO2-eq from EPA eGrid, 2005
GHG Emissions in tons of CO2-eq (With Project) - Gravity design eliminates need for pumps
Maintenance Effort (Without Project) - Estimates of 2 FTEs based on distributed site design and mechanical techniques and is broken down between 3,000 hours Landscape Maintenance Worker at $11/hr, 1,000 hours of Professional Worker at $65/hr, and 160 hours of Landscape Operator at $47/hr. Labor information from the State of California Department of Industrial Relations.
Maintenance Effort (With Project) - Estimates of 1 FTE based on designs and techniques and is broken down between 1,500 hours Landscape Maintenance Worker at $11/hr, 500 hours of Professional Worker at $65/hr, and 80 hours of Landscape Operator at $47/hr. Labor information from State of California Department of Industrial Relations.
Recreation Trails in Miles (Without Project) - The Without Project alternative provides zero trail miles
Recreation Trails in Miles (With Project) - Estimates provided by Vandermost Consulting Services, Inc.
Wetland Habitat in Acres (Without Project) - The Without Project alternative provides zero wetland habitat acres
Wetland Habitat in Acres (With Project) - Estimates provided by Vandermost Consulting Services, Inc.
Upland Habitat in Acres (Without Project) - The Without Project alternative provides zero wetland habitat acres
Upland Habitat in Acres (With Project) - Estimates provided by Vandermost Consulting Services, Inc.

ESCALATIONS - ALL HELD AT ZERO
Clean Water Esc. Factor (2.5%/yr) - Estimated by 1/2 of low range of potable water rates escalations of 5 - 11% per year (MWD of So. Cal.)
Energy Costs Esc. Factor (0.5%/yr) - Inland Empire Utility Agency
Labor Cost Esc. Factor (2.0%/yr) -

(1) Complete these columns if dollar value is being claimed for the benefit.

Project (g) Cactus Basins

B. Water Quality and Other Benefits:

Narrative discussion of the estimates of without-project physical:

Currently, the site is an otherwise unused quarry that is being used as an interim flood control basin and there are no groundwater recharge activities taking place at the site. Also, per the requirements of the environmental permits, the District will be obligated to set aside 40 acres of mitigation land off-site as well as restore 0.8 acres of habitat on-site. Without the project, the 40 off-site acres would otherwise be potentially subject to development. If developed, there would be a loss of habitat and undisturbed land. Without the 0.8 acres of rehabilitation, the site would remain in its current disturbed state as an retired quarry.

Narrative discussion of the estimates of with-project physical condition:

The design of Cactus Basins 3 and 3A will include features so that it may be used as a groundwater recharge facility. It is estimated that the site could have a capacity of up to 12,000 AFY. Also, per the requirements of the Environmental permits, the District will be obligated to set aside 40 acres of mitigation land off-site as well as restore 0.8 acres of habitat on-site. This will allow the District to set aside acreage that will remain undisturbed habitat in perpetuity. The on-site habitat restoration will be re-vegetated with native plant material on land that would have otherwise been left a disturbed piece of land on a retired quarry site.

Description of methods used to estimate without- and with-project condition:

Per the 1988 EIR, the annual recharge capacity for Basins 3 through 5 is estimated at 35,000 acre feet per year. Given the relative areas of Basins 3 and 3A, the recharge capacity of the project is estimated to be 12,000 acre-feet per year. The mitigation land and habitat restoration are both conditions of the environmental permits associated with the project. If not for the Cactus Basin No 3 project neither the 40 acres of off-site mitigation land or the 0.8 acres of habitat restoration would be required.

Description of potential other benefits:

Not Applicable

Description of the distribution of local, regional, and statewide benefits, as applicable:

The groundwater recharge benefit will be utilized on a local level. The increased water supply will be used by the local water purveyor for usage by customers within the basin. The mitigation land would have more a regional impact in that it will be part of a much larger area of land that is currently in a natural, undisturbed state.

Identification of beneficiaries:

Beneficiaries of the increased water supply will be the water purveyors and their customers. The environmental mitigation has a much more wide-spreading impact and beneficiaries which are somewhat difficult to quantify. The ecology will benefit in that the mitigation land will be preserved in perpetuity. It can also be said that quality of life of all those who use that site will increase since they will be experiencing the land in its natural, undisturbed state.

When the benefits will be received:

The small portion of the groundwater recharge benefit will be realized after the first storm after project completion as storm water will naturally percolate to the storage basins below. Full groundwater recharge benefit will be seen as soon as the District enters into a cooperative use agreement with a water purveyor to utilize the site for groundwater recharge. The environmental preservation will be realized immediately as it is a condition of construction of the project.

Uncertainty of Benefits:

The District needs to enter into an agreement with water purveyors in order to fully utilize the site for groundwater recharge. Negotiations have not yet begun though there has been interest from at least one purveyor.

Description of any adverse effects:

None

Table 16 - Water Quality and Other Expected Benefits
(All benefits should be in 2009 dollars)
Project (g) Cactus Basin (SBCFCD)

(a)	(b)	(c)	(d)	(e)	(f)	(g)	(h)	(i)	(j)
Year	Type of Benefit	Measure of Benefit (Units)	Without Project	With Project	Change Resulting from Project (e) – (d)	Unit $ Value (1)	Annual $ Value (f) x (g) (1)	Discount Factor (1)	Discounted Benefits (h) x (i) (1)
2009									
	c				0		$0		$0
	..				0		$0		$0
2010	a				0		$0		$0
	b				0		$0		$0
	c				0		$0		$0
	..				0		$0		$0
2011	Environmental	Acres	0	40.8	40.8		$0		$0
	Groundwater Recharge	AFY	0	12,000	12000	$400	$4,800,000	0.89	$4,272,000
2012	Groundwater Recharge	AFY	0	12,000	12000	$400	$4,800,000	0.84	$4,032,000
2013	Groundwater Recharge	AFY	0	12,000	12000	$400	$4,800,000	0.792	$3,801,600
2014	Groundwater Recharge	AFY	0	12,000	12000	$400	$4,800,000	0.747	$3,585,600
2015	Groundwater Recharge	AFY	0	12,000	12000	$400	$4,800,000	0.705	$3,384,000
2016	Groundwater Recharge	AFY	0	12,000	12000	$400	$4,800,000	0.665	$3,192,000
2017	Groundwater Recharge	AFY	0	12,000	12000	$400	$4,800,000	0.627	$3,009,600
2018	Groundwater Recharge	AFY	0	12,000	12000	$400	$4,800,000	0.592	$2,841,600
2019	Groundwater Recharge	AFY	0	12,000	12000	$400	$4,800,000	0.558	$2,678,400
2020	Groundwater Recharge	AFY	0	12,000	12000	$400	$4,800,000	0.527	$2,529,600
2021	Groundwater Recharge	AFY	0	12,000	12000	$400	$4,800,000	0.497	$2,385,600
2022	Groundwater Recharge	AFY	0	12,000	12000	$400	$4,800,000	0.469	$2,251,200
2023	Groundwater Recharge	AFY	0	12,000	12000	$400	$4,800,000	0.442	$2,121,600
2024	Groundwater Recharge	AFY	0	12,000	12000	$400	$4,800,000	0.417	$2,001,600
2025	Groundwater Recharge	AFY	0	12,000	12000	$400	$4,800,000	0.394	$1,891,200
2026	Groundwater Recharge	AFY	0	12,000	12000	$400	$4,800,000	0.371	$1,780,800
2027	Groundwater Recharge	AFY	0	12,000	12000	$400	$4,800,000	0.35	$1,680,000
2028	Groundwater Recharge	AFY	0	12,000	12000	$400	$4,800,000	0.331	$1,588,800
2029	Groundwater Recharge	AFY	0	12,000	12000	$400	$4,800,000	0.312	$1,497,600

Table 16 - Water Quality and Other Expected Benefits
(All benefits should be in 2009 dollars)
Project (g) Cactus Basin (SBCFCD)

(a) Year	(b) Type of Benefit	(c) Measure of Benefit (Units)	(d) Without Project	(e) With Project	(f) Change Resulting from Project (e) – (d)	(g) Unit $ Value (1)	(h) Annual $ Value (f) x (g) (1)	(i) Discount Factor (1)	(j) Discounted Benefits (h) x (i) (1)
2030	Groundwater Recharge	AFY	0	12,000	12000	$400	$4,800,000	0.294	$1,411,200
2031	Groundwater Recharge	AFY	0	12,000	12000	$400	$4,800,000	0.278	$1,334,400
2032	Groundwater Recharge	AFY	0	12,000	12000	$400	$4,800,000	0.262	$1,257,600
2033	Groundwater Recharge	AFY	0	12,000	12000	$400	$4,800,000	0.247	$1,185,600
2034	Groundwater Recharge	AFY	0	12,000	12000	$400	$4,800,000	0.233	$1,118,400
2035	Groundwater Recharge	AFY	0	12,000	12000	$400	$4,800,000	0.22	$1,056,000
2036	Groundwater Recharge	AFY	0	12,000	12000	$400	$4,800,000	0.207	$993,600
2037	Groundwater Recharge	AFY	0	12,000	12000	$400	$4,800,000	0.196	$940,800
2038	Groundwater Recharge	AFY	0	12,000	12000	$400	$4,800,000	0.185	$888,000
2039	Groundwater Recharge	AFY	0	12,000	12000	$400	$4,800,000	0.174	$835,200
2040	Groundwater Recharge	AFY	0	12,000	12000	$400	$4,800,000	0.164	$787,200
2041	Groundwater Recharge	AFY	0	12,000	12000	$400	$4,800,000	0.155	$744,000
2042	Groundwater Recharge	AFY	0	12,000	12000	$400	$4,800,000	0.146	$700,800
2043	Groundwater Recharge	AFY	0	12,000	12000	$400	$4,800,000	0.138	$662,400
2044	Groundwater Recharge	AFY	0	12,000	12000	$400	$4,800,000	0.13	$624,000
2045	Groundwater Recharge	AFY	0	12,000	12000	$400	$4,800,000	0.123	$590,400
2046	Groundwater Recharge	AFY	0	12,000	12000	$400	$4,800,000	0.116	$556,800
2047	Groundwater Recharge	AFY	0	12,000	12000	$400	$4,800,000	0.109	$523,200
2048	Groundwater Recharge	AFY	0	12,000	12000	$400	$4,800,000	0.103	$494,400
2049	Groundwater Recharge	AFY	0	12,000	12000	$400	$4,800,000	0.097	$465,600
2050	Groundwater Recharge	AFY	0	12,000	12000	$400	$4,800,000	0.092	$441,600
2051	Groundwater Recharge	AFY	0	12,000	12000	$400	$4,800,000	0.087	$417,600
2052	Groundwater Recharge	AFY	0	12,000	12000	$400	$4,800,000	0.082	$393,600
2053	Groundwater Recharge	AFY	0	12,000	12000	$400	$4,800,000	0.077	$369,600
2054	Groundwater Recharge	AFY	0	12,000	12000	$400	$4,800,000	0.073	$350,400
2055	Groundwater Recharge	AFY	0	12,000	12000	$400	$4,800,000	0.069	$331,200
2056	Groundwater Recharge	AFY	0	12,000	12000	$400	$4,800,000	0.065	$312,000
2057	Groundwater Recharge	AFY	0	12,000	12000	$400	$4,800,000	0.061	$292,800

Table 16 - Water Quality and Other Expected Benefits
(All benefits should be in 2009 dollars)
Project (g) Cactus Basin (SBCFCD)

(a)	(b)	(c)	(d)	(e)	(f)	(g)	(h)	(i)	(j)
Year	Type of Benefit	Measure of Benefit (Units)	Without Project	With Project	Change Resulting from Project (e) – (d)	Unit $ Value (1)	Annual $ Value (f) x (g) (1)	Discount Factor (1)	Discounted Benefits (h) x (i) (1)
2058	Groundwater Recharge	AFY	0	12,000	12000	$400	$4,800,000	0.058	$278,400
2059	Groundwater Recharge	AFY	0	12,000	12000	$400	$4,800,000	0.055	$264,000
Total Present Value of Discounted Benefits Based on Unit Value (Sum of the values in Column (j) for all Benefits shown in table) Transfer to Table 20, column (f), Exhibit F: Proposal Costs and Benefits Summaries									$71,145,600

Comments:

(1) Complete these columns if dollar value is being claimed for the benefit.

Project (h) Inland Empire Brine Line Rehabilitation and Enhancement

B. Water Quality and Other Benefits:

Narrative discussion of the estimates of without-project physical:

The Project is located beneath the Prado Dam area, on which the US Army Corps of Engineers recently completed a project to raise the height of the dam by approximately 28 feet. The dam will operate with a higher maximum water surface and additional sediments will be deposited. As a result, SAWPA has had to consider various options to meet the new water and sediment loading conditions imposed by the operation of the dam. A technical memorandum completed by RBF Consulting in 2008 recommended rehabilitation over the relocation of the Lower Reach IVB brine line. Without the Project however, SAWPA would need to pursue the relocation project which would achieve the same increase in useful life but cost substantially more to complete because SAWPA would need to purchase right-of-way for the pipeline and for the construction easement. Furthermore, the relocation option would result in greater environmental impacts to the wetland habitats around the Prado Dam.

If no alternative is pursued, the existing Reinforced Concrete Pipe (RCP) has a remaining useful life of approximately 10 years. However, with a significant flood event requiring the additional flood storage capacity that has been created at Prado Dam, the structural integrity of the pipeline may be compromised and increase the risk of catastrophic failure. A break in the pipeline could result in a disruption of service to the entire Inland Empire affecting water supply projects and local/regional businesses. Furthermore, the discharge would affect the wetland habitats around the dam and contaminate any groundwater/surface water sources in the area.

Without the project, EMWD and WMWD would have no means of disposing waste brine from the desalter process that would not have any economic feasibility. The salt that would otherwise be removed would remain in the groundwater basin, resulting in adverse impacts to groundwater quality, ecosystems and water quality in the Santa Ana River from groundwater that migrates to the river system. Therefore, there are zero benefits to the “no project” alternative, as shown in column (d) “Without Project”, Table 16. The benefits of avoidance of these adverse impacts are addressed in the following discussion of “with-project” benefits.

Narrative discussion of the estimates of with-project physical condition:

The Project would provide for the removal of over 30,000 tons/yr of salt through the Lower Reach IVB from the production of 23,295 AFY of water in EMWD and/or WMWD service areas. Removal of salt for the basin results in reduced economic impacts to the basin, including the impacts to crop production, economic life of equipment and appliances, impacts to habitat, etc. Cost avoidance of regulatory fines for not meeting salinity targets also adds to the list of benefits.

“With project” water quality “secondary” benefits from the EMWD and WMWD projects are rolled up as primary water quality benefits for this project. This aggregated benefit is further increased to account for the unused capacity from the 4 mgd expansion, based on the assumption that over the life of the project this additional capacity will be used evenly by EMWD and WMWD as new wells and desalters are constructed to meet their district’s needs.

Furthermore, the Project will eliminate the effect of the on-going structural deterioration of the unlined RCP, reduce the risk of a catastrophic failure in the environmentally sensitive Prado Basin and provide the structural support to meet the loading conditions imposed by the increased flood storage capacity of Prado Dam. Through the rehabilitation of the pipeline the Project will extend the useful life of the Lower Reach IVB Brine Line an additional 50 years.

Description of methods used to estimate without- and with-project condition:

The metric used to measure water quality benefits is acre-ft of water pumped from the basin. This is based on the assumption that the groundwater salt loading is approximately constant across the basins, i.e. the salt removed from the basin is proportional to the AF of groundwater pumped from the basin. The annual volume of pumped groundwater that will equal the new additional capacity in the SARI line is determined by dividing the new 4 mgd (4,484 AFY) by 16.14% brine waste production through the desalter. Therefore, 27,779 AF is entered in column (e) of Table 16.

The unit dollar value of the benefit is determined by taking the average unit dollar value from the EMWD and the WMWD analysis, based on the current projection of demand from the two agencies being approximately equal over the life of the project. Since the WMWD's metric is AFY of groundwater pumped from the basin and the EMWD's metric is tons of salt removed per year from the basin, a conversion must occur to calculate an "apples to apples" metric. Therefore, for the purposes of this analysis, the EMWD metric and column (g) unit dollar value was converted to AFY. The unit dollar values were then averaged and entered in column (g) of Table 16.

Description of potential other benefits:

1. The Project will improve the structural integrity of Lower Reach IVB pipeline located underneath Prado Dam.
2. The Project will protect wildlife in the Santa Ana Watershed

Description of the distribution of local, regional, and statewide benefits, as applicable:

Benefit	**Measure**	**Value**	**Beneficiaries**
Improve Groundwater Quality	Quantitative	$1,145 per AF	Local/Regional
Increase Structural Integrity of Pipeline at Prado Dam	Qualitative	+++	Local/Regional/Statewide
Protection of Valuable Water Resources and Wildlife in Santa Ana Watershed	Qualitative	+++	Local/Regional/Statewide

+ Likely to have minor impacts
++ Likely to have significant impacts
+++ Likely to have very significant impacts

Local/Regional:

1. The Project will improve the structural integrity of the Lower Reach IVB pipeline located underneath Prado Dam area.
2. The Project will protect wildlife in the Santa Ana Watershed

Statewide:
The Project will benefit the State by reducing reliance on imported water.

Identification of beneficiaries:

1. EMWD and WMWD will benefit from increased structural integrity of Lower Reach IVB pipeline located underneath Prado Dam.
2. The Santa Ana Watershed will benefit by protecting wildlife in the watershed.
3. The watershed will benefit by reducing the salt imbalance.
4. The State will benefit from reduced reliance on imported water in the Santa Ana Watershed.

When the benefits will be received:

The Project is expected to be completed by November 2012. The additional capacity created by the Project will be available for use after this date, although SAWPA anticipates that EMWD and WMWD will require this additional capacity between 2015 and 2020.

Uncertainty of Benefits:

Although the Project is creating additional capacity for discharge resulting primarily from treatment of groundwater, the actual creation of new potable water will be dependent on future desalting projects that will utilize the available capacity in the SARI Brine Line.

Description of any adverse effects:

Adverse Effects	**Measure**	**Impact**
Short Term Construction Impacts to Air Quality	Qualitative	+
Impacts to Biological Resources Habitat Conservation Plans	Qualitative	+

+ Likely to have minor impacts
++ Likely to have significant impacts
+++ Likely to have very significant impacts

Table 16 - Water Quality and Other Expected Benefits
(All benefits should be in 2009 dollars)
SAWPA
Project (h) Inland Empire Brine Line Rehabilitation and Enhancement (SAWPA)

(a)	(b)	(c)	(d)	(e)	(f)	(g)	(h)	(i)	(j)
Year	Type of Benefit	Measure of Benefit (Units)	Without Project	With Project	Change Resulting from Project (e) – (d)	Unit $ Value (1)	Annual $ Value (f) x (g) (1)	Discount Factor (1)	Discounted Benefits (h) x (i) (1)
2009	Salt Removal	Acre-Feet	0	0	0		$0	1.000	$0
2010	Salt Removal	Acre-Feet	0	0	0		$0	0.943	$0
2011	Salt Removal	Acre-Feet	0	0	0		$0	0.890	$0
2012	Salt Removal	Acre-Feet	0	0	0		$0	0.840	$0
2013	Salt Removal	Acre-Feet	0	27,779	27,779	$1,145	$31,806,955	0.792	$25,194,088
2014	Salt Removal	Acre-Feet	0	27,779	27,779	$1,145	$31,806,955	0.747	$23,768,007
2015	Salt Removal	Acre-Feet	0	27,779	27,779	$1,145	$31,806,955	0.705	$22,422,648
2016	Salt Removal	Acre-Feet	0	27,779	27,779	$1,145	$31,806,955	0.665	$21,153,442
2017	Salt Removal	Acre-Feet	0	27,779	27,779	$1,145	$31,806,955	0.627	$19,956,077
2018	Salt Removal	Acre-Feet	0	27,779	27,779	$1,145	$31,806,955	0.592	$18,826,488
2019	Salt Removal	Acre-Feet	0	27,779	27,779	$1,145	$31,806,955	0.558	$17,760,838
2020	Salt Removal	Acre-Feet	0	27,779	27,779	$1,145	$31,806,955	0.527	$16,755,507
2021	Salt Removal	Acre-Feet	0	27,779	27,779	$1,145	$31,806,955	0.497	$15,807,082
2022	Salt Removal	Acre-Feet	0	27,779	27,779	$1,145	$31,806,955	0.469	$14,912,342
2023	Salt Removal	Acre-Feet	0	27,779	27,779	$1,145	$31,806,955	0.442	$14,068,247
2024	Salt Removal	Acre-Feet	0	27,779	27,779	$1,145	$31,806,955	0.417	$13,271,931
2025	Salt Removal	Acre-Feet	0	27,779	27,779	$1,145	$31,806,955	0.394	$12,520,690
2026	Salt Removal	Acre-Feet	0	27,779	27,779	$1,145	$31,806,955	0.371	$11,811,971
2027	Salt Removal	Acre-Feet	0	27,779	27,779	$1,145	$31,806,955	0.350	$11,143,369
2028	Salt Removal	Acre-Feet	0	27,779	27,779	$1,145	$31,806,955	0.331	$10,512,612
2029	Salt Removal	Acre-Feet	0	27,779	27,779	$1,145	$31,806,955	0.312	$9,917,559
2030	Salt Removal	Acre-Feet	0	27,779	27,779	$1,145	$31,806,955	0.294	$9,356,188
2031	Salt Removal	Acre-Feet	0	27,779	27,779	$1,145	$31,806,955	0.278	$8,826,592
2032	Salt Removal	Acre-Feet	0	27,779	27,779	$1,145	$31,806,955	0.262	$8,326,974
2033	Salt Removal	Acre-Feet	0	27,779	27,779	$1,145	$31,806,955	0.247	$7,855,636
2034	Salt Removal	Acre-Feet	0	27,779	27,779	$1,145	$31,806,955	0.233	$7,410,977
2035	Salt Removal	Acre-Feet	0	27,779	27,779	$1,145	$31,806,955	0.220	$6,991,488
2036	Salt Removal	Acre-Feet	0	27,779	27,779	$1,145	$31,806,955	0.207	$6,595,743
2037	Salt Removal	Acre-Feet	0	27,779	27,779	$1,145	$31,806,955	0.196	$6,222,399
2038	Salt Removal	Acre-Feet	0	27,779	27,779	$1,145	$31,806,955	0.185	$5,870,188
2039	Salt Removal	Acre-Feet	0	27,779	27,779	$1,145	$31,806,955	0.174	$5,537,913
2040	Salt Removal	Acre-Feet	0	27,779	27,779	$1,145	$31,806,955	0.164	$5,224,446
2041	Salt Removal	Acre-Feet	0	27,779	27,779	$1,145	$31,806,955	0.155	$4,928,723
2042	Salt Removal	Acre-Feet	0	27,779	27,779	$1,145	$31,806,955	0.146	$4,649,739
2043	Salt Removal	Acre-Feet	0	27,779	27,779	$1,145	$31,806,955	0.138	$4,386,546
2044	Salt Removal	Acre-Feet	0	27,779	27,779	$1,145	$31,806,955	0.130	$4,138,251
2045	Salt Removal	Acre-Feet	0	27,779	27,779	$1,145	$31,806,955	0.123	$3,904,010
2046	Salt Removal	Acre-Feet	0	27,779	27,779	$1,145	$31,806,955	0.116	$3,683,029
2047	Salt Removal	Acre-Feet	0	27,779	27,779	$1,145	$31,806,955	0.109	$3,474,555
2048	Salt Removal	Acre-Feet	0	27,779	27,779	$1,145	$31,806,955	0.103	$3,277,882
2049	Salt Removal	Acre-Feet	0	27,779	27,779	$1,145	$31,806,955	0.097	$3,092,342
2050	Salt Removal	Acre-Feet	0	27,779	27,779	$1,145	$31,806,955	0.092	$2,917,304
2051	Salt Removal	Acre-Feet	0	27,779	27,779	$1,145	$31,806,955	0.087	$2,752,173
2052	Salt Removal	Acre-Feet	0	27,779	27,779	$1,145	$31,806,955	0.082	$2,596,390
2053	Salt Removal	Acre-Feet	0	27,779	27,779	$1,145	$31,806,955	0.077	$2,449,424
2054	Salt Removal	Acre-Feet	0	27,779	27,779	$1,145	$31,806,955	0.073	$2,310,778
2055	Salt Removal	Acre-Feet	0	27,779	27,779	$1,145	$31,806,955	0.069	$2,179,979
2056	Salt Removal	Acre-Feet	0	27,779	27,779	$1,145	$31,806,955	0.065	$2,056,584
2057	Salt Removal	Acre-Feet	0	27,779	27,779	$1,145	$31,806,955	0.061	$1,940,173
2058	Salt Removal	Acre-Feet	0	27,779	27,779	$1,145	$31,806,955	0.058	$1,830,352
2059	Salt Removal	Acre-Feet	0	27,779	27,779	$1,145	$31,806,955	0.054	$1,726,747
2060	Salt Removal	Acre-Feet	0	27,779	27,779	$1,145	$31,806,955	0.051	$1,629,007
2061	Salt Removal	Acre-Feet	0	27,779	27,779	$1,145	$31,806,955	0.048	$1,536,799
2062	Salt Removal	Acre-Feet	0	27,779	27,779	$1,145	$31,806,955	0.046	$1,449,810
Project Life								…	
Total Present Value of Discounted Benefits Based on Unit Value (Sum of the values in Column (j) for all Benefits shown in table) Transfer to Table 20, column (f), Exhibit F: Proposal Costs and Benefits Summaries									$420,932,038

Comments:

Project (i) Arlington Desalter Interconnection Project

B. Water Quality and Other Benefits:

Not Applicable

Project (j) Perris II Desalination Facility

B. Water Quality and Other Benefits:

Narrative discussion of the estimates of without-project physical:

EMWD's waste discharge requirements incorporate the Basin Plan Amendment, Resolution No. R8-2004-0001, that has adopted new salt and nutrient objectives for the Groundwater Management Zones ("GMZ") within the Santa Ana Region to include the San Jacinto River Watershed. The removal of nutrients through EMWD's desalinization system is the mitigation activity that has been approved to offset the excess mass loading of nutrients from reuse in the Lakeview/Hemet North GMZ ("LV/HN").

Currently, EMWD treats raw sewage to reclaimed water ("RW") standards and conveys effluent to storage/infiltration ponds. RW that infiltrates into the basin increases the salinity of the aquifer. EMWD mitigates this increase in salinity by pumping groundwater from the aquifer and treating to potable quality standards through the desalter project. This serves to not only create a new local water supply, but also, by removing this brackish water to offset the increased salinity introduced into the aquifer due to percolation of RW from the storage ponds.

Without the Project, EMWD would need to line the storage basins to prevent infiltration (cost prohibitive) or treat RW to a standard high enough to ensure that percolation from the storage basins does not increase groundwater salinity.

Narrative discussion of the estimates of with-project physical condition:

The Project will pump and treat approximately 1,000 acre-feet per year ("AFY") from the basin, removing approximately 2,000 tons/yr of salts and 8.5 tons/yr of nutrients ("Nitrate"), and reducing the overall salt/nutrient content in the basin. The Project, consisting of a new brackish well and pipeline system, will send brackish groundwater through the desalter system, creating a new supply of 700 AFY of potable water, and will send 300 AFY of residual brine waste water down the SARI line.

As discussed in the "Without Project" section, EMWD will be able to continue utilizing the RW storage ponds in their current un-lined condition, having mitigated the salinity impacts of RW re-use and infiltration into the aquifer by pumping brackish groundwater for salt removal at the desalter. Dissolved salts that would otherwise be retained in the aquifer will be removed at the desalter and sent down the SARI line in the form of concentrated brackish waste water (brine).

Description of methods used to estimate without- and with-project condition:

The water quality benefits related to this project consist of the qualitative benefits to the watershed resulting from decreased salt loading in the aquifer, addressing exceedances of Primary MCLs for Nitrate and Perchlorate, and the quantitative benefits of reduced or avoided costs of reclaimed water re-use or disposal.

The qualitative benefits of reduced salinity and other constituents in the aquifer include lower impacts on water users. Those impacts range from degradation of appliances, pipes and other water

infrastructure, to effects on water taste, lower crop yields and other environmental and public health/public acceptance impacts.
Quantified benefits to water quality are summarized in Table 16 “Water Quality and Other Expected Benefits”. The metric used to measure water quality benefits is tons of salt removed from the aquifer. Using an average well production rate of 1,000 AFY and a salt removal yield of two tons per acre-ft, an annual salt removal rate of 2,000 tons per year is found in column (e) of Table 16. Without the Project there would be no salt removal, therefore no mitigation of RW percolation at the storage ponds.

It is assumed that if EMWD did not construct this project, the District would have to treat the RW prior to storage in the ponds in order to insure that the receiving groundwater salinity would not be impacted. Therefore the dollar value of this benefit would accrue at a rate equal to the cost of treatment on a per ton of removed salt basis. A unit value of $898 per ton was used in column (g) to calculate the dollar value of this benefit. This number is based on EMWD actual costs for treatment at $1,795 per acre-ft. Field data at EMWD facilities suggest that the average yield of removed salts is approximately 2 tons per acre-ft. This converts to $898 per ton.

In order to provide a net present worth representation of the sum of the annual calculated benefits, discount factors found in column (i) are multiplied by the dollar value of the annual benefits in column (h) and summed in column (j) to get a total benefit of $21 million.

<u>Description of potential other benefits:</u>

The Project will reduce CO2 emissions by reducing overall energy costs to provide potable water. The net reduction in CO2 emissions is the difference in energy consumption in Kilowatt hours (“kWh”), between delivering imported water to the distribution system, and the energy required in kWh, to collect and treat groundwater through the desalter. This net energy savings is easily converted to CO2 emissions from Southern California Edison (“Edison”) power plants by using appropriate local conversion factors, provided by Edison.

<u>Description of the distribution of local, regional, and statewide benefits, as applicable:</u>

Benefit	Measure	Value	Beneficiaries
Reduce Migration of Brackish Groundwater	Qualitative	+++	Local/Regional
Improve Groundwater Quality	Quantitative	$898 per ton	Local/Regional
Reduced CO2 Emissions	Qualitative	++	Statewide

'+ Likely to have minor impacts
++ Likely to have significant impacts
+++ Likely to have very significant impacts

Local/Regional:

1. The Project will remove salts from the groundwater basin, improve the water quality in the LV/HN basin, and address exceedances of Primary MCLs for Nitrate and Perchlorate.
2. The Project will reduce the migration of brackish water and protect potable groundwater resources.

3. The Project will mitigate salt and nutrient loading, and accommodate for future growth by exceeding current mitigation requirements.

Statewide:

1. The Project will reduce overall CO_2 emissions by reducing demand for imported water.

Identification of beneficiaries:

1. EMWD service area will benefit from reduced salinity and improved water quality in the groundwater basin.
2. EMWD will benefit from growth in recycled water usage as a result of mitigating salt and nutrient loading.
3. The State will benefit from a reduction in overall CO_2 emissions.

When the benefits will be received:

The benefits of the Project will be received starting in 2013, when the well begins to supply the Desalters with brackish groundwater.

Uncertainty of Benefits:

Project will construct a brackish water well that is expected to produce approximately 1,000 AFY in brackish water. This estimate is based on the production levels of adjacent wells, but may be an over- or under-estimation depending on the geology of the site and the final depth achieved. The cost estimates assume that the well will be approximately 350 feet deep. However, if the maximum depth of 520 feet was reached, the cost of the Project will increase. In order to avoid construction delays from increasing costs, EMWD will bid out the Project assuming the maximum depth of 520 feet. Once the well is complete, the unused budget will be accounted for as a cost savings.

The costs used for treatment are based on average water quality found at the existing wells within the basin. Actual water quality found at the proposed well may vary from the average, and therefore affect the estimated cost of water treatment.

Description of any adverse effects:

The Project will have one-time construction impacts, although mitigation provisions have been included in the specifications for the well construction and for the well equipping.

Table 16 - Water Quality and Other Expected Benefits
(All benefits should be in 2009 dollars)
Project (j) Perris II Desalination Facility (EMWD)

(a)	(b)	(c)	(d)	(e)	(f)	(g)	(h)	(i)	(j)
Year	Type of Benefit	Measure of Benefit (Units)	Without Project	With Project	Change Resulting from Project (e) – (d)	Unit $ Value (1)	Annual $ Value (f) x (g) (1)	Discount Factor (1)	Discounted Benefits (h) x (i) (1)
2009	Salt Removal	tons	0	0	0		$0	1.000	$0
2010	Salt Removal	tons	0	0	0		$0	0.943	$0
2011	Salt Removal	tons	0	0	0		$0	0.890	$0
2012	Salt Removal	tons	0	0	0		$0	0.840	$0
2013	Salt Removal	tons	0	2,000	2,000	$898	$1,796,000	0.792	$1,422,600
2014	Salt Removal	tons	0	2,000	2,000	$898	$1,796,000	0.747	$1,342,076
2015	Salt Removal	tons	0	2,000	2,000	$898	$1,796,000	0.705	$1,266,109
2016	Salt Removal	tons	0	2,000	2,000	$898	$1,796,000	0.665	$1,194,443
2017	Salt Removal	tons	0	2,000	2,000	$898	$1,796,000	0.627	$1,126,833
2018	Salt Removal	tons	0	2,000	2,000	$898	$1,796,000	0.592	$1,063,050
2019	Salt Removal	tons	0	2,000	2,000	$898	$1,796,000	0.558	$1,002,877
2020	Salt Removal	tons	0	2,000	2,000	$898	$1,796,000	0.527	$946,110
2021	Salt Removal	tons	0	2,000	2,000	$898	$1,796,000	0.497	$892,557
2022	Salt Removal	tons	0	2,000	2,000	$898	$1,796,000	0.469	$842,035
2023	Salt Removal	tons	0	2,000	2,000	$898	$1,796,000	0.442	$794,373
2024	Salt Removal	tons	0	2,000	2,000	$898	$1,796,000	0.417	$749,408
2025	Salt Removal	tons	0	2,000	2,000	$898	$1,796,000	0.394	$706,989
2026	Salt Removal	tons	0	2,000	2,000	$898	$1,796,000	0.371	$666,970
2027	Salt Removal	tons	0	2,000	2,000	$898	$1,796,000	0.350	$629,217
2028	Salt Removal	tons	0	2,000	2,000	$898	$1,796,000	0.331	$593,601
2029	Salt Removal	tons	0	2,000	2,000	$898	$1,796,000	0.312	$560,001
2030	Salt Removal	tons	0	2,000	2,000	$898	$1,796,000	0.294	$528,303
2031	Salt Removal	tons	0	2,000	2,000	$898	$1,796,000	0.278	$498,399
2032	Salt Removal	tons	0	2,000	2,000	$898	$1,796,000	0.262	$470,188
2033	Salt Removal	tons	0	2,000	2,000	$898	$1,796,000	0.247	$443,573
2034	Salt Removal	tons	0	2,000	2,000	$898	$1,796,000	0.233	$418,466
2035	Salt Removal	tons	0	2,000	2,000	$898	$1,796,000	0.220	$394,779
2036	Salt Removal	tons	0	2,000	2,000	$898	$1,796,000	0.207	$372,433
2037	Salt Removal	tons	0	2,000	2,000	$898	$1,796,000	0.196	$351,352
2038	Salt Removal	tons	0	2,000	2,000	$898	$1,796,000	0.185	$331,464
2039	Salt Removal	tons	0	2,000	2,000	$898	$1,796,000	0.174	$312,702
2040	Salt Removal	tons	0	2,000	2,000	$898	$1,796,000	0.164	$295,002
2041	Salt Removal	tons	0	2,000	2,000	$898	$1,796,000	0.155	$278,303
2042	Salt Removal	tons	0	2,000	2,000	$898	$1,796,000	0.146	$262,550
2043	Salt Removal	tons	0	2,000	2,000	$898	$1,796,000	0.138	$247,689
Project Life								…	
Total Present Value of Discounted Benefits Based on Unit Value (Sum of the values in Column (j) for all Benefits shown in table) Transfer to Table 20, column (f), Exhibit F: Proposal Costs and Benefits Summaries									$21,004,452
Comments:									

(1) Complete these columns if dollar value is being claimed for the benefit.

Project (k) Perchlorate Wellhead Treatment System Pipelines

B. Water Quality and Other Benefits:

Estimates of without-project conditions; e.g. current and future water supplies and demand:

The Rialto Well No. 6 site represents a location in the Rialto-Colton Groundwater Basin where elevated maximum concentrations of perchlorate (up to 320 micrograms per liter [μg/l]) and TCE (up to 6.3 μg/l) have been detected. The maximum contaminant levels (MCLs) in drinking water are 6 and 5 μg/l, respectively, as listed in Title 22 of the California Code of Regulations (CCR). Increasing perchlorate detections caused the City to inactivate Rialto Well No. 6 for drinking water supply in December 2001. Although WVWD Well No. 11 is currently detecting perchlorate concentrations around the MCL, it has not operated significantly since 2002. It is anticipated and expected that when WVWD Well No. 11 begins pumping again, perchlorate concentrations will increase quickly, and VOCs may be detected.

Without the Project, approximately 36,000 tons of salt will remain in the groundwater basin over the next 30 years, equivalent to the time-span of the proposed Project. Furthermore, the perchlorate, TCE, and nitrate plumes have already reached and contaminated numerous PWS well sources, and continue to migrate unabated. The contamination will continue to spread to downstream users. To date, the contaminant sources remain uncontrolled, and thus, the sources of perchlorate and TCE to groundwater are being replenished with each substantive rain event. This condition will remain until source-area remediation is performed. The rainwater infiltrating to groundwater moves through residual soil contamination and continues to leach to the groundwater.

Estimates of with-project conditions; e.g. improvements in new water supplies made available to meet demand:

The Project will result in the removal of approximately 114 tons/yr of perchlorate, TCE and nitrates, and 1,200 tons/yr of salt from groundwater. As discussed in the “without- and with-project conditions” section, the avoided annual cost of removing salts from 4,302 AFY of raw water is estimated to be $493 per AF. Therefore, the Project will result in an annual avoided-cost benefit of $2.1 million. Moreover, the present value of the benefit over 30 year useful life of the Project is approximately $25.1 million.

While there is no way to quantify the benefits of the removing 114 tons/yr of perchlorate and nitrates from the groundwater, remediating and abating a severe and still migrating plume of contamination is invaluable to the Basin. This benefit will result in minimizing the total duration and cost required for cleanup, and will help to decrease the adverse impacts to groundwater wells downgradient of the Project, and also in other groundwater basins.

Description of methods used to estimate without- and with-project conditions:

In order to analyze the with-and-without Project conditions, the benefits of salt removal as well as those of reducing perchlorate and nitrates, were analyzed.

1. <u>Reduced Salinity Benefits:</u>

The metric used to quantify salt removal from the basin is AF of groundwater pumped and treated, assuming a constant level of salt loading in the groundwater. Therefore, the water quality benefit realized from the project is the quantity of removed salts more easily expressed in terms of AFY of pumped and treated groundwater. The above mentioned value of 4,302 AFY is entered in column (e), Table 16.

In a 2009 study conducted at U.C. Davis, “The Economic Impacts of Central Valley Salinity”, researchers estimated that the annual economic impacts to the Central Valley due to increased groundwater salinity could reach $3.7 billion. These impacts include, among other things, reduced crop production and reduced economic life of water pipes, appliances, and equipment. In a separate study by J.F. Poland, “Ground Water in California” Poland estimated a statewide groundwater pumping level of 10 million AFY, of which the Central Valley accounted for 75%. Therefore, the economic impacts of groundwater salinity in the Central Valley on a per AF basis, is calculated by dividing the $3.7 billion by 7.5 million AFY, which results in $493 per AF. Therefore, a value of $493 per AF is entered in column (g), “Unit $ Value”, Table 16.

2. <u>Reduced Perchlorate and Nitrates Benefit:</u>

The regional benefits of perchlorate and nitrate reduction resulting from the Project were not quantified in this analysis. Further discussion and data regarding the cost of treatment and the benefits of reduced population exposed to perchlorate is found in the US EPA’s “Final Statement of Reasons – Perchlorate Primary Maximum Contaminant Level (MCL), Title 22, California Code of Regulations”, June 25, 2007.

<u>Description of potential other benefits:</u>

The Project will protect public health by reducing perchlorate, TCE and nitrate concentrations in the groundwater.

<u>Perchlorate Impact on Human Health:</u>

In 2008, the Deputy Director for Scientific Affairs of the Office Environmental Health Hazard Assessment (“OEHHA”) stated in testimony before the U.S. Senate (OEHHA, 2008) that:

“Our health concern is this: Perchlorate inhibits the uptake of iodide, an essential nutrient, by the thyroid gland. Inadequate iodide uptake disrupts proper thyroid function. Thyroid hormones, such thyroxine (T4) and triiodothoronine (T3), help regulate the growth and maturation of tissues, particularly the brain. Disruption of these hormones due to iodine deficiency can lead to impaired growth and development in fetuses. Several epidemiological studies indicate that iodine deficiency during pregnancy may affect brain development and may cause intellectual deficits in children.”

Perchlorate as studied by OEHHA (OEHHA, 2004) in developing a public health goal (“PHG”) was found to have developmental affects primarily in sensitive populations. As stated by OEHHA: “One of the more serious human health effects observed in scientific studies is perchlorate’s disruption of thyroid hormone production.” Also, “Pregnant women and their developing fetuses may suffer the most serious health effects from perchlorate contamination in drinking water, particularly in the first and second trimesters of pregnancy. During this period, the fetal thyroid is not yet fully functional, so the mother's thyroid must be able to produce enough extra T4 hormone to enable her baby's brain to develop properly."

TCE Impact on Human Health:

In 2008 the Deputy Director for Scientific Affairs of OEHHA stated in testimony before the U.S. Senate (OEHHA, 2008) that:

"Over the past 20 years, California has consistently treated TCE as a carcinogen in our air, water, and other programs. In April 1988, California listed trichloroethylene as a "chemical known to the state to cause cancer" (under the California Safe Drinking Water and Toxic Enforcement Act of 1986, also known as Proposition 65). In 1990, we developed a "no significant risk" level to help businesses determine when Californians must receive Proposition 65 warnings concerning exposure to TCE. Also that year, we reviewed trichloroethylene for our air toxics program and again concluded that it should be considered a carcinogen for purposes of public health protection. TCE was listed as a toxic air contaminant based on the carcinogenic effects."

In the 2009 PHG for TCE (OEHHA, 2009), OEHHA considered TCE as a human carcinogen. It is acutely toxic at moderate to low concentrations.

Nitrate Impact on Human Health:

Nitrate as studied by OEHHA (OEHHA, 1997) had a PHG calculated, "based on the protection of infants from the occurrence of methemoglobinemia," the principal toxic effect observed in humans exposed to nitrate or nitrite.

Greenhouse Gas Emissions:

The Project will reduce CO_2 emissions by reducing overall energy costs to provide potable water. Using the appropriate CO_2 emission factors, the net reduction in CO_2 emissions is calculated from the difference between the energy required to import water to the distribution system and the energy to collect and treat the groundwater. Based on an article published by the Water Environment Federation ("WEF") in 2008, deliveries of SWP water require approximately 3.25 mWh/AF. Moreover, WVWD estimates that pumping and treating groundwater will require approximately 2.28 mWh/AF. After accounting for other Project related emissions, WVWD estimates that the Project will result in a 58% reduction in tons of CO_2 emitted, per AF of water produced. (See Att8_WVWD_WQOtherBen_2of4.pdf for backup details and calculations).

Description of the distribution of local, regional, and statewide benefits, as applicable:

Benefit	**Measure**	**Value**	**Beneficiaries**
Improve Groundwater Quality	Quantitative	$439 per AF	Local/Regional
Reduce Spread of Perchlorate and Nitrates	Qualitative	+++	Local/Regional
Reduced Risk of Health Effects of Perchlorate, TCE and Nitrates	Qualitative	+++	Local/Regional/Statewide

+ Likely to have minor impacts
++ Likely to have significant impacts
+++ Likely to have very significant impacts

Local/Regional:

1. The Project will remove 1,200 tons/yr of salts from the groundwater basin thereby improving the overall water quality.

2. The Project will remove 114 tons/yr of perchlorate and nitrates, and protect the water quality downgradient from the Project.

Statewide:
1. The Project will reduce the risk of long-term health effects of perchlorate, TCE and nitrate by the concentration of those contaminants in the groundwater.

2. The Project will decrease Statewide CO_2 emissions, by reducing reliance on SWP water.

Identification of beneficiaries:

1. City of Rialto and WVWD service area will benefit from removal of salts which will increase the overall groundwater quality.

2. City of Rialto, WVWD service area and downstream water producers/users will benefit from reduced perchlorate, TCE and nitrate levels.

3. The State will benefit from reduced risks of long-term health impacts resulting from perchlorate, TCE and nitrate contamination.

4. The State will benefit from reduced demand for imported water, low energy costs, and reduced CO_2 emissions.

When the benefits will be received:

The benefits will accrue over time, starting in 2012.

Uncertainty of Benefits:

There are no uncertainties to the benefits of the Project. All other aspects of the WTP are fully funded and will be functional starting in 2012.

Description of any adverse effects:

There are no known adverse effects resulting from the Project.

Sources:

Impacts of High Salinity:
Howitt et. Al., University of California Davis, "The Economic Impacts of Central Valley Salinity", March 16, 2009. (See Att8_WVWD_WQOtherBen_3of4.pdf.)

Poland, Groundwater in California, AIME TRANSACTIONS, FEB 1950, VOL 187, pg. 280. (See Att8_WVWD_WQOtherBen_4of4.pdf.)

Table 16 - Water Quality and Other Expected Benefits

(All benefits should be in 2009 dollars)

Project (k) Perchlorate Wellhead Treatment System Pipelines (WVWD)

(a) Year	(b) Type of Benefit	(c) Measure of Benefit (Units)	(d) Without Project	(e) With Project	(f) Change Resulting from Project (e) – (d)	(g) Unit $ Value (1)	(h) Annual $ Value (f) x (g) (1)	(i) Discount Factor (1)	(j) Discounted Benefits (h) x (i) (1)
2009	Salt Removal	Acre-feet	0	0	0	$493	$0	1.000	$0
2010	Salt Removal	Acre-feet	0	0	0	$493	$0	0.943	$0
2011	Salt Removal	Acre-feet	0	0	0	$493	$0	0.890	$0
2012	Salt Removal	Acre-feet	0	717	717	$493	$353,481	0.840	$296,924
2013	Salt Removal	Acre-feet	0	4,302	4,302	$493	$2,120,886	0.792	$1,679,742
2014	Salt Removal	Acre-feet	0	4,302	4,302	$493	$2,120,886	0.747	$1,584,302
2015	Salt Removal	Acre-feet	0	4,302	4,302	$493	$2,120,886	0.705	$1,495,225
2016	Salt Removal	Acre-feet	0	4,302	4,302	$493	$2,120,886	0.665	$1,410,389
2017	Salt Removal	Acre-feet	0	4,302	4,302	$493	$2,120,886	0.627	$1,329,796
2018	Salt Removal	Acre-feet	0	4,302	4,302	$493	$2,120,886	0.592	$1,255,565
2019	Salt Removal	Acre-feet	0	4,302	4,302	$493	$2,120,886	0.558	$1,183,454
2020	Salt Removal	Acre-feet	0	4,302	4,302	$493	$2,120,886	0.527	$1,117,707
2021	Salt Removal	Acre-feet	0	4,302	4,302	$493	$2,120,886	0.497	$1,054,080
2022	Salt Removal	Acre-feet	0	4,302	4,302	$493	$2,120,886	0.469	$994,696
2023	Salt Removal	Acre-feet	0	4,302	4,302	$493	$2,120,886	0.442	$937,432
2024	Salt Removal	Acre-feet	0	4,302	4,302	$493	$2,120,886	0.417	$884,409
2025	Salt Removal	Acre-feet	0	4,302	4,302	$493	$2,120,886	0.394	$835,629
2026	Salt Removal	Acre-feet	0	4,302	4,302	$493	$2,120,886	0.371	$786,849
2027	Salt Removal	Acre-feet	0	4,302	4,302	$493	$2,120,886	0.350	$742,310
2028	Salt Removal	Acre-feet	0	4,302	4,302	$493	$2,120,886	0.331	$702,013
2029	Salt Removal	Acre-feet	0	4,302	4,302	$493	$2,120,886	0.312	$661,716
2030	Salt Removal	Acre-feet	0	4,302	4,302	$493	$2,120,886	0.294	$623,540
2031	Salt Removal	Acre-feet	0	4,302	4,302	$493	$2,120,886	0.278	$589,606
2032	Salt Removal	Acre-feet	0	4,302	4,302	$493	$2,120,886	0.262	$555,672
2033	Salt Removal	Acre-feet	0	4,302	4,302	$493	$2,120,886	0.247	$523,859
2034	Salt Removal	Acre-feet	0	4,302	4,302	$493	$2,120,886	0.233	$494,166
2035	Salt Removal	Acre-feet	0	4,302	4,302	$493	$2,120,886	0.220	$466,595
2036	Salt Removal	Acre-feet	0	4,302	4,302	$493	$2,120,886	0.207	$439,023
2037	Salt Removal	Acre-feet	0	4,302	4,302	$493	$2,120,886	0.196	$415,694
2038	Salt Removal	Acre-feet	0	4,302	4,302	$493	$2,120,886	0.185	$392,364
2039	Salt Removal	Acre-feet	0	4,302	4,302	$493	$2,120,886	0.174	$369,034
2040	Salt Removal	Acre-feet	0	4,302	4,302	$493	$2,120,886	0.164	$347,825
2041	Salt Removal	Acre-feet	0	4,302	4,302	$493	$2,120,886	0.155	$328,737
2042	Salt Removal	Acre-feet	0	4,302	4,302	$493	$2,120,886	0.146	$309,649
2043	Salt Removal	Acre-feet	0	4,302	4,302	$493	$2,120,886	0.138	$292,682
Project Life								…	
Total Present Value of Discounted Benefits Based on Unit Value (Sum of the values in Column (j) for all Benefits shown in table) Transfer to Table 20, column (f), Exhibit F: Proposal Costs and Benefits Summaries									$25,100,686

Comments: (g) Economic Impact due to groundwater salinity = $3.7 billion per year. Central Valley pumps approximately 7.5 million AFY. Therefore, economic impact /af = $3.7 billion/ 7.5 million AFY = $493/af. See narrative for sources.

Project (l) Chino Creek Wellfield Development

B. Water Quality and Other Benefits:

Narrative discussion of the estimates of without-project physical:

High salt and nitrate concentrations are two long-standing water quality issues in the Chino Basin. Between January 2001 and June 2006, over half of all wells (452 wells) in the Chino Basin exceeded the Department of Public Health's maximum contaminant level ("MCL") for nitrate and nearly half of all wells (359 wells) exceeded the MCL for salts (as measured by Total Dissolved Solids ("TDS")).

Without the Project, approximately 150,000 tons of salt will remain in the Chino Basin over the next 50 years, equivalent to the time-span of the proposed Project. Coupled with groundwater overflow from the Chino Basin into the Santa Ana River, it is likely that salt will continue to affect not only the quality of water in the Chino Basin and the River, but also the water quality and ecosystems downgradient from the project.

In addition to the qualitative impacts discussed above, if WMWD were not to build this project: a) high salinity groundwater would migrate through the basin and enter the Santa Ana River watercourse, increasing downstream costs of salt removal for potable and reclaimed water providers; 2) economic impacts would be felt by agricultural and industrial and residential customers in the service area, consisting of, but not limited to, crop production, reduced economic life of mechanical equipment, plant and turf damage in landscape and recreational areas; and 3)the Regional Water Quality Control Board ("RWQCB") could levy fines for failure to achieve hydraulic control of the Chino Basin which results in low quality groundwater entering the Sana Ana River.

Narrative discussion of the estimates of with-project physical condition:

WMWD actual field data show that the treatment of 2,900 AFY from the Chino Creek Wellfield will result in the removal of over 3,000 tons/yr of salt from the Chino Basin, eventually transported for downstream treatment through the SARI line. This project, though primarily a water supply project, will provide a secondary benefit by removing salts from the groundwater basin and by providing hydraulic control of the aquifer that will significantly reduce the migration of high salinity groundwater to the Santa Ana River system, thereby reducing the salinity impacts to downstream ecosystems and improving overall water quality.

Description of methods used to estimate without- and with-project condition:

The water quality benefits related to this project consist of the qualitative benefits to the watershed resulting from decreased salt loading in the aquifer, and the quantitative benefits of reduced or avoided costs of downstream treatment, economic impacts to water users in the service area and regulatory fines and penalties.

The qualitative benefits of reduced salinity in the local water supply include less impact to crops, landscaped areas, recreational uses, habitat and overall water quality in streams and wetlands.

Quantified benefits to water quality are summarized in Table 16, "Water Quality and Other Expected Benefits". In order to analyze the water quality benefits of the Project three methodologies were used, consistent with the discussion of the "without project" paragraph above.

Approach #1:

If high salinity groundwater should migrate to the Santa Ana River, the cost of treatment would be greater, on a per AF basis, than the cost of treatment at the Chino desalter. A dollar unit value representing the additional cost of treatment downstream would be used, on the order of several hundred dollars per AF above and beyond the cost of treatment at the Project site.

Approach #2:

In a study conducted by U.C. Davis, "The Economic Impacts of Central Valley Salinity", researchers estimated that the annual economic impacts to the Central Valley due to increased groundwater salinity could reach $3.7 billion. These impacts include, among other things, reduced crop production and reduced economic life of water pipes, appliances, and equipment. In a separate study by J.F. Poland, "Ground Water in California" Poland estimated a statewide groundwater pumping level of 10 million AFY, of which the Central Valley accounted for 75%. Therefore, the economic impacts of groundwater salinity in the Central Valley on a per AF basis, is calculated by dividing the $3.7 billion by 7.5 million AFY, which results in $493 per AF.

Approach #3:

The avoided cost of regulatory fines was used to quantify this benefit. In Compliant No. R8-2010-0013, the Santa Ana Regional Water Quality Control Board stated that "an assessment of $5,000 per day is appropriate" based on "the potential harm from the failure to maintain hydraulic control". However, using this number to calculate an annual avoided cost of fines and penalties would be unreasonable. WMWD is committed to the Project and it is irrational to assume that any entity would continue to pay regular fines when implementing the proposed project solution would eventually prove less expensive.

It was determined that Approach #2 is the most reasonable measure of benefit. Therefore, the metric used to measure water quality benefits is acre-feet per year pumped, or 2,900 AFY, which is used in column (e) of Table 16. The cost of $493 per AF identified in the discussion of Approach #2 is the value used in column (g) of Table 16.

Description of potential other benefits:

Reduction in CO2 emissions:

The proposed Project provides a local water supply, 2,500 AFY, in-lieu of import of SWP water. It is estimated that SWP water delivered to the East Branch Extension requires 3,250 kWh/AF. Water from the Chino I Desalter is expected to use only about 2,280 kWh/AF (including desalting and operation of the wells). Given that the Project will generate 2,500 AFY, this is an annual reduction of over 2.4 million kWh. Assuming 5.883x10-4 metric tons of CO2/year per kWh, then approximately 1,427 metric tons of CO2 will be avoided annually.

Project energy use was taken from the Chino Desalter Phase 3 Comprehensive Predesign Report dated August 2009 prepared by Carollo Engineers. SWP (East Branch) energy use was taken from “Energy Intensity of Selected Water Supply Sources in Southern California” by Professor Robert Wilkinson, Bren School, University of California, Santa Barbara, cited in “The Role of Recycled Water In Energy Efficiency and Greenhouse Gas Reduction” by the California Public Utilities Commission May 2008.

Description of the distribution of local, regional, and statewide benefits, as applicable:

Benefit	Measure	Value	Beneficiaries
Reduce flow of Degraded Groundwater into Santa Ana River	Qualitative	+++	Local/Regional
Improve Groundwater Quality	Quantitative	$493 per AF	Local/Regional
Reduced CO2 emissions	Qualitative	++	Statewide

+ Likely to have minor impacts
++ Likely to have significant impacts
+++ Likely to have very significant impacts

Local/Regional:

1. The Project will reduce the salinity in the Chino North Management Zone.
2. The Project will improve the water quality in the Santa Ana River and downstream, by reducing the flow of degraded groundwater into the River.

Statewide:

The Project will reduce overall CO_2 emissions by reducing reliance on SWP water.

Identification of beneficiaries:

1. The Chino Basin, specifically the Chino North Management Zone, will benefit from reduced salinity.

2. Downstream users will benefit from improved water quality resulting from the Project increasing groundwater pumping.

3. Ecosystems in and around the Santa Ana River will benefit from reduced degraded groundwater flows.

4. The State will benefit from reduced demand for imported water, low energy costs, and reduced CO_2 emissions.

When the benefits will be received:

The benefits of the Project will be received starting in 2012, when the well begins to supply the existing Chino I Desalter with groundwater.

Uncertainty of Benefits:

The Project consists of three (3) wells to that are expected to produce approximately 2,900 AFY in raw water. This estimate may be an over- or under-estimation depending on the geology of the site and the final well depth achieved. Project capital and treatment costs are based on expected well depth and water quality among other factors. Actual conditions may vary, and could impact project costs and benefits.

Description of any adverse effects:

There are no known adverse effects resulting from the Project.

Table 16 - Water Quality and Other Expected Benefits
(All benefits should be in 2009 dollars)
WMWD
Project (I) Chino Creek Wellfield Development (WMWD)

(a)	(b)	(c)	(d)	(e)	(f)	(g)	(h)	(i)	(j)
Year	Type of Benefit	Measure of Benefit (Units)	Without Project	With Project	Change Resulting from Project (e) – (d)	Unit $ Value (1)	Annual $ Value (f) x (g) (1)	Discount Factor (1)	Discounted Benefits (h) x (i) (1)
2009	Salt Removal	Acre-Feet	0	0	0	$493	$0	1.000	$0
2010	Salt Removal	Acre-Feet	0	0	0	$493	$0	0.943	$0
2011	Salt Removal	Acre-Feet	0	0	0	$493	$0	0.890	$0
2012	Salt Removal	Acre-Feet	0	2,900	2,900	$493	$1,429,700	0.840	$1,200,404
2013	Salt Removal	Acre-Feet	0	2,900	2,900	$493	$1,429,700	0.792	$1,132,456
2014	Salt Removal	Acre-Feet	0	2,900	2,900	$493	$1,429,700	0.747	$1,068,355
2015	Salt Removal	Acre-Feet	0	2,900	2,900	$493	$1,429,700	0.705	$1,007,882
2016	Salt Removal	Acre-Feet	0	2,900	2,900	$493	$1,429,700	0.665	$950,832
2017	Salt Removal	Acre-Feet	0	2,900	2,900	$493	$1,429,700	0.627	$897,011
2018	Salt Removal	Acre-Feet	0	2,900	2,900	$493	$1,429,700	0.592	$846,237
2019	Salt Removal	Acre-Feet	0	2,900	2,900	$493	$1,429,700	0.558	$798,337
2020	Salt Removal	Acre-Feet	0	2,900	2,900	$493	$1,429,700	0.527	$753,148
2021	Salt Removal	Acre-Feet	0	2,900	2,900	$493	$1,429,700	0.497	$710,517
2022	Salt Removal	Acre-Feet	0	2,900	2,900	$493	$1,429,700	0.469	$670,299
2023	Salt Removal	Acre-Feet	0	2,900	2,900	$493	$1,429,700	0.442	$632,358
2024	Salt Removal	Acre-Feet	0	2,900	2,900	$493	$1,429,700	0.417	$596,564
2025	Salt Removal	Acre-Feet	0	2,900	2,900	$493	$1,429,700	0.394	$562,796
2026	Salt Removal	Acre-Feet	0	2,900	2,900	$493	$1,429,700	0.371	$530,940
2027	Salt Removal	Acre-Feet	0	2,900	2,900	$493	$1,429,700	0.350	$500,887
2028	Salt Removal	Acre-Feet	0	2,900	2,900	$493	$1,429,700	0.331	$472,534
2029	Salt Removal	Acre-Feet	0	2,900	2,900	$493	$1,429,700	0.312	$445,787
2030	Salt Removal	Acre-Feet	0	2,900	2,900	$493	$1,429,700	0.294	$420,554
2031	Salt Removal	Acre-Feet	0	2,900	2,900	$493	$1,429,700	0.278	$396,749
2032	Salt Removal	Acre-Feet	0	2,900	2,900	$493	$1,429,700	0.262	$374,292
2033	Salt Removal	Acre-Feet	0	2,900	2,900	$493	$1,429,700	0.247	$353,105
2034	Salt Removal	Acre-Feet	0	2,900	2,900	$493	$1,429,700	0.233	$333,118
2035	Salt Removal	Acre-Feet	0	2,900	2,900	$493	$1,429,700	0.220	$314,262
2036	Salt Removal	Acre-Feet	0	2,900	2,900	$493	$1,429,700	0.207	$296,474
2037	Salt Removal	Acre-Feet	0	2,900	2,900	$493	$1,429,700	0.196	$279,692
2038	Salt Removal	Acre-Feet	0	2,900	2,900	$493	$1,429,700	0.185	$263,861
2039	Salt Removal	Acre-Feet	0	2,900	2,900	$493	$1,429,700	0.174	$248,925
2040	Salt Removal	Acre-Feet	0	2,900	2,900	$493	$1,429,700	0.164	$234,835
2041	Salt Removal	Acre-Feet	0	2,900	2,900	$493	$1,429,700	0.155	$221,543
2042	Salt Removal	Acre-Feet	0	2,900	2,900	$493	$1,429,700	0.146	$209,002
2043	Salt Removal	Acre-Feet	0	2,900	2,900	$493	$1,429,700	0.138	$197,172
2044	Salt Removal	Acre-Feet	0	2,900	2,900	$493	$1,429,700	0.130	$186,011
2045	Salt Removal	Acre-Feet	0	2,900	2,900	$493	$1,429,700	0.123	$175,482
2046	Salt Removal	Acre-Feet	0	2,900	2,900	$493	$1,429,700	0.116	$165,550
2047	Salt Removal	Acre-Feet	0	2,900	2,900	$493	$1,429,700	0.109	$156,179
2048	Salt Removal	Acre-Feet	0	2,900	2,900	$493	$1,429,700	0.103	$147,338
2049	Salt Removal	Acre-Feet	0	2,900	2,900	$493	$1,429,700	0.097	$138,999
2050	Salt Removal	Acre-Feet	0	2,900	2,900	$493	$1,429,700	0.092	$131,131
2051	Salt Removal	Acre-Feet	0	2,900	2,900	$493	$1,429,700	0.087	$123,708
2052	Salt Removal	Acre-Feet	0	2,900	2,900	$493	$1,429,700	0.082	$116,706
2053	Salt Removal	Acre-Feet	0	2,900	2,900	$493	$1,429,700	0.077	$110,100
2054	Salt Removal	Acre-Feet	0	2,900	2,900	$493	$1,429,700	0.073	$103,868
2055	Salt Removal	Acre-Feet	0	2,900	2,900	$493	$1,429,700	0.069	$97,989
2056	Salt Removal	Acre-Feet	0	2,900	2,900	$493	$1,429,700	0.065	$92,442
2057	Salt Removal	Acre-Feet	0	2,900	2,900	$493	$1,429,700	0.061	$87,209
2058	Salt Removal	Acre-Feet	0	2,900	2,900	$493	$1,429,700	0.058	$82,273
2059	Salt Removal	Acre-Feet	0	2,900	2,900	$493	$1,429,700	0.054	$77,616
2060	Salt Removal	Acre-Feet	0	2,900	2,900	$493	$1,429,700	0.051	$73,223
2061	Salt Removal	Acre-Feet	0	2,900	2,900	$493	$1,429,700	0.048	$69,078
2062	Salt Removal	Acre-Feet	0	2,900	2,900	$493	$1,429,700	0.046	$65,168
Project Life								…	
Total Present Value of Discounted Benefits Based on Unit Value (Sum of the values in Column (j) for all Benefits shown in table) Transfer to Table 20, column (f), Exhibit F: Proposal Costs and Benefits Summaries									$20,120,999

Comments:

(1) Complete these columns if dollar value is being claimed for the benefit.

Project (m) Impaired Groundwater Recovery

B. Water Quality and Other Benefits:

Narrative discussion of the estimates of without-project physical:

Wells 21 and 22 were originally constructed in 1992, located in the city of Tustin. The water quality in both wells contain nitrate, total dissolved solids (TDS) and total hardness levels above regulated standards. These wells overlie an area of the Orange County groundwater basin with elevated nitrate and TDS levels. The wells were rehabilitated in 2009 and Title 22 testing showed Well 21 water quality results show that the nitrate concentration increased since 1992 and TDS also increased; Well 22 water quality results showed that nitrate and TDS had also increased since 1992. The nitrate levels for Well 21 is 67 mg/L and is 50 mg/L for Well 22. The maximum contaminant level is 45 mg/L. The TDS for well 21 was 740 mg/L and Well 22 was 650 mg/L and the recommended secondary limit is 500 mg/L. Total hardness (as a measure of calcium carbonate $CaCO_3$) in these wells and nearby wells exhibit very high concentrations greater than 200 mg/L and range as high as 620 mg/L. Elevated levels of nitrate and TDS and hardness in this area of the Orange County groundwater basin originated from fertilizer use.

Narrative discussion of the estimates of with-project physical condition:

IRWD currently distributes ground water from its Deep Aquifer Treatment System, Dyer Road Well Field and the Irvine Desalter Project treatment plant that meets all state and federal guidelines all within the Orange County groundwater basin. The proposed project finished water quality goals include nitrate levels not to exceed 36 mg/L and hardness goals set at 180 mg/L. The goal for TDS was set to not exceed 420 mg/L which corresponds to the TDS of the product water from the IRWD's existing Irvine Desalter Project treatment plant. The preliminary design report completed in 2009, showed that the water could not be used for potable purposes without treatment. The alternatives reviewed included possibility of blending the untreated will water with other local water or imported water or ion exchange, reverse osmosis membranes or a hybrid process using ion exchange and membranes.

Description of methods used to estimate without- and with-project condition:

To gain an understanding of the current water quality and potential future trends in contaminant concentrations, IRWD evaluated the results of well sampling along with the historical water quality from Wells 21 and 22 and compared with several nearby wells. Those constituents that do not meet regulated standards will require some method of treatment prior to introduction into IRWD's system. Per the PDR, during pump testing in 2009, water samples were collected from Wells 21 and 22 near the end of the 24-hour constant rate pumping tests and were submitted for State of California Code of Regulations Title 22 testing. Additionally, water quality samples were collected at the end of the 6 hours of continuous pumping in Zones 1 and 2 isolation tests and were submitted for analysis of general mineral, physical properties, VOC's, metals, TOC and perchlorate. The water quality in this basin was analyzed over time by reviewing Wells 21 and 22 and other nearby wells' historical data for key constituents. Historical groundwater quality and water level data were provided by Orange County Water District for 13 wells in the vicinity of Wells 21 and 22. The groundwater in the vicinity of Wells 21 and 22 has periodically exceeded the maximum contaminant level (MCL) of several constituents. The constituents of greatest concern in the area are nitrate, TDS, perchlorate and hardness. The concentrations of these chemicals have not changed significantly over time with the exception of nitrate, which has increased in several of the wells over time. The purpose of this analysis is to examine ground water quality trends in the area to assess future groundwater quality trends at Wells 21 and 22.

Description of potential other benefits:

The project will also help to remove degraded groundwater from the Orange County Basin which will ultimately benefit other basin groundwater producers.

Description of the distribution of local, regional, and statewide benefits, as applicable:

The project will also help to remove degraded groundwater from the Orange County Basin which will ultimately benefit other basin groundwater producers.

Identification of beneficiaries:

The water customers of Irvine Ranch Water District will be the beneficiaries of the project. Ultimately, removal of groundwater elevated in nitrates and TDS would benefit groundwater basin quality by reducing the ability of this groundwater to spread and impact other portions of the Orange County groundwater basin.

When the benefits will be received:

The project will be constructed in 2010-11 and is expected to be operational in early 2012.

Uncertainty of Benefits:

There is no known uncertainty associated with the project benefits.

Description of any adverse effects:

There are no known adverse effects from the project.

Table 16 - Water Quality and Other Expected Benefits (All benefits should be in 2009 dollars) Project (m) Impaired Groundwater Recovery (IRWD)									
(a)	(b)	(c)	(d)	(e)	(f)	(g)	(h)	(i)	(j)
Year	Type of Benefit	Measure of Benefit (Units)	Without Project	With Project	Change Resulting from Project (e) – (d)	Unit $ Value (1)	Annual $ Value (f) x (g) (1)	Discount Factor (1)	Discounted Benefits (h) x (i) (1)
2009	removal of salts	tons/year							
2010	removal of salts	tons/year							
2011	removal of salts	tons/year	0	5593	5593		$0	1.000	$0
2012	removal of salts	tons/year	0	5593	5593		$0	0.943	$0
2013	removal of salts	tons/year	0	5593	5593		$0	0.890	$0
2014	removal of salts	tons/year	0	5593	5593		$0	0.840	$0
2015	removal of salts	tons/year	0	5593	5593		$0	0.792	$0
2016	removal of salts	tons/year	0	5593	5593		$0	0.747	$0
2017	removal of salts	tons/year	0	5593	5593		$0	0.705	$0
2018	removal of salts	tons/year	0	5593	5593		$0	0.665	$0
2019	removal of salts	tons/year	0	5593	5593		$0	0.627	$0
2020	removal of salts	tons/year	0	5593	5593		$0	0.592	$0
2021	removal of salts	tons/year	0	5593	5593		$0	0.558	$0
2022	removal of salts	tons/year	0	5593	5593		$0	0.527	$0
2023	removal of salts	tons/year	0	5593	5593		$0	0.497	$0
2024	removal of salts	tons/year	0	5593	5593		$0	0.469	$0
2025	removal of salts	tons/year	0	5593	5593		$0	0.442	$0
2026	removal of salts	tons/year	0	5593	5593		$0	0.417	$0
2027	removal of salts	tons/year	0	5593	5593		$0	0.394	$0
2028	removal of salts	tons/year	0	5593	5593		$0	0.371	$0
2029	removal of salts	tons/year	0	5593	5593		$0	0.350	$0
2030	removal of salts	tons/year	0	5593	5593		$0	0.331	$0
2031	removal of salts	tons/year	0	5593	5593		$0	0.312	$0
2032	removal of salts	tons/year	0	5593	5593		$0	0.294	$0
2033	removal of salts	tons/year	0	5593	5593		$0	0.278	$0
2034	removal of salts	tons/year	0	5593	5593		$0	0.262	$0
2035	removal of salts	tons/year	0	5593	5593		$0	0.247	$0
2036	removal of salts	tons/year	0	5593	5593		$0	0.233	$0

Table 16 - Water Quality and Other Expected Benefits
(All benefits should be in 2009 dollars)
Project (m) Impaired Groundwater Recovery (IRWD)

(a)	(b)	(c)	(d)	(e)	(f)	(g)	(h)	(i)	(j)
Year	Type of Benefit	Measure of Benefit (Units)	Without Project	With Project	Change Resulting from Project (e) – (d)	Unit $ Value (1)	Annual $ Value (f) x (g) (1)	Discount Factor (1)	Discounted Benefits (h) x (i) (1)
2037	removal of salts	tons/year	0	5593	5593		$0	0.220	$0
2038	removal of salts	tons/year	0	5593	5593		$0	0.207	$0
2039	removal of salts	tons/year	0	5593	5593		$0	0.196	$0
2040	removal of salts	tons/year	0	5593	5593		$0	0.185	$0
2041	removal of salts	tons/year	0	5593	5593		$0	0.174	$0
2042	removal of salts	tons/year	0	5593	5593		$0	0.164	$0
2043	removal of salts	tons/year	0	5593	5593		$0	0.155	$0
2044	removal of salts	tons/year	0	5593	5593		$0	0.146	$0
2045	removal of salts	tons/year	0	5593	5593		$0	0.138	$0
2046	removal of salts	tons/year	0	5593	5593		$0	0.130	$0
2047	removal of salts	tons/year	0	5593	5593		$0	0.123	$0
2048	removal of salts	tons/year	0	5593	5593		$0	0.116	$0
2049	removal of salts	tons/year	0	5593	5593		$0	0.109	$0
2050	removal of salts	tons/year	0	5593	5593		$0	0.103	$0
2051	removal of salts	tons/year	0	5593	5593		$0	0.097	$0
Project Life									
Total Present Value of Discounted Benefits Based on Unit Value (Sum of the values in Column (j) for all Benefits shown in table) Transfer to Table 20, column (f), Exhibit F: Proposal Costs and Benefits Summaries									

Comments: The Project Prelminary Design Report estimates the reverse osmosis plant will remove 34,000 pounds per day of salts which equates to 17 tons and estimated 5,593 tons per year. The calculation is based on a plant duty factor of 90% or 329 days.

(1) Complete these columns if dollar value is being claimed for the benefit.